

Bridging the Gaps in Internet Development in Africa

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1) Introduction

This study seeks to build on the activities of those who have helped chart the events in Africa toward universal access to low cost electronic communications and the associated activities that need to take place to build Africa's Information Society. It aims to identify the most important gaps in this development process, focusing on the countries, regions and sectors in African society that could benefit most from the increased involvement of IDRC.

There are a number of different elements to this process that have taken place in this study:

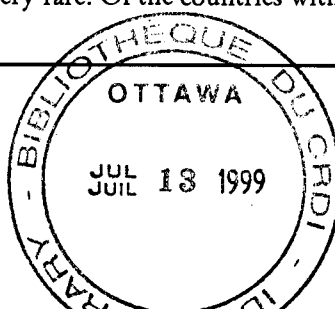
- 1) Data on projects taking place in countries and regions in Sub-Saharan Africa was assembled along with basic information about the status of the country's Internet related infrastructure. This was obtained from ongoing monitoring activities. Assignment of points to the various activities and conditions in the countries and sectors produced an indicator system to rank countries, regions and sectors according to the 'health' of their Internet related developments.
- 2) Further analysis was done to describe the conditions in each Sub-Saharan country and its current state of development in the various areas. Since many of the gaps in development are simply caused by lack of information on what is possible, best practices and successful initiatives that could be replicated elsewhere were identified.
- 3) Discussion of various possible activities that IDRC could play a role in to improve the situation were identified, taking into account opportunities to exploit new technological developments, collaboration with centres of expertise and congruent initiatives. Since the Internet is generally at a such a low level of development all over Africa, and the use of ICTs cuts across all fields, many of the activities identified could be applied almost anywhere on the continent and in any sector, rather than only in a particular region or social grouping.
- 4) Aside from seeking to find the direct gaps in development, opportunities to boost Internet development in Africa that were not currently being exploited were also identified that could feed into the process of national or sectoral support.

2.0) The current environment and recent Internet related developments in Africa

While most developing countries are experiencing fairly rapid extension and modernisation of their telecommunication networks, Sub-Saharan Africa's teledensity has continued to remain at less than one per 200 inhabitants, most of the telecommunication network is analogue and many sections are highly unreliable, especially during the rainy season. Since the utility of the Internet depends to a great extent on the quality of the underlying telecommunication infrastructure, the poor quality of the network still remains a basic impediment to rapid developments in this area.

Despite the poor telecommunication infrastructure, over half of the African countries have developed some form of low cost local dialup store and forward email service with a gateway to the Internet - 33 of the 54 nations on the continent. Of these, twenty countries have achieved live Internet public access services in the capital cities: Algeria, Angola, Central African Republic, Benin, Cote d'Ivoire, Madagascar, Mauritius, Morocco, Tanzania, Tunisia, Egypt, Senegal, Ghana, Uganda, Kenya, Swaziland, Zambia, Zimbabwe, Namibia, Mozambique and of course South Africa, which is among the top 20 countries in the world when ranked by number of Internet nodes. A further 8 countries have well advanced plans for establishing an Internet node: Burkina Faso, Botswana, Gabon, Ethiopia, Mali, Mauritania, Guinea, Sierra Leone. (See Maps in the Appendix).

If this pattern continues, there will be few African capitals without live Internet by the end of the year, although local access for the rest of the nation will still be very rare. Of the countries with full Internet, only South Africa,



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Mauritius and Senegal have pervasive local dialup facilities outside of the capital city while Benin and Kenya have services in the second major city.

Subscription charges for dialup Internet access in Africa vary greatly - between \$10 and \$100 a month - which means that in some countries, even if a computer is available, the service is beyond the reach of all but the top elite.

Also, because telephone call charges to the service provider are usually the major cost, the absence of a national service effectively cuts off the majority of the population from the Internet. Reflecting the high cost of full Internet based services, and also because of the overriding importance of electronic mail, the small email-only store and forward systems with dialup connections to the Internet are generally continuing to attract subscribers.

A recent development of note has been the alacrity with which African public telecom operators, PTTs, have started to establish Internet services. PTTs in Benin, Central African Republic, Djibouti, Mauritius, Madagascar, Senegal and South Africa have recently brought full Internet services on stream, and now similar moves are afoot in Angola, Ethiopia, Gambia, Gabon, Guinea, Mali, Sierra Leone, Tanzania, and Zimbabwe. This follows trends in the developed countries where almost all of the major PTTs have established Internet services. Even if liberalisation of the regulatory environment becomes more widespread in Africa, the much larger economies of scale that the PTTs can apply to the provision of Internet services suggests that it is unclear how any but the largest multinational providers (CompuServe, UUNET, Global One) and some special interest groups will gain a significant share of their markets.

In some cases the PTT has defined itself as the 'only' supplier, in others private companies are allowed to resell Internet services. In quite a few cases the regulations restricting resale have not been obeyed to the letter by private ISPs but the PTTs have usually turned a blind eye. Other countries have been more extensively liberalised and the PTT may have no direct role in the growing ISP market.

The majority of international connections to the rest of the Internet operate on analogue circuits rated at 9.6Kbps, but often pushed to 14Kbps and sometimes to 24Kbps. None of the countries outside of South Africa had international circuits larger than 64Kbps until very recently when Tunisia and Egypt upgraded to 128Kbps. Upgrades to 128Kbps are also expected shortly in Senegal and Kenya, although by contrast, South Africa has a half dozen international links, most of which are over 256Kbps and some are up to 2.8 Mbps. While some Internet circuits in Africa connect to the United Kingdom and France, (as well as one to Italy), the majority connect to the USA where suppliers include AT&T, Global One, UUNET/AlterNet, MCI, NSN, Sprint and BBN. Nevertheless, France Telecom/FCR has more Internet connections into Africa than any other single supplier, largely because of its close ties with Francophone PTTs.

SITA, the airline co-operative, has also emerged as an important influence on the Internet in Africa. With points in every African country, it is upgrading its network for dialup and leased line Internet access wherever regulations allow. It has signed a continent wide agreement to host the PANA Web/ISP network, the IPS correspondents network and many corporate TCP/IP based networks such as DHL. SITA is also supplying the 19.2K link between Dar es Salaam and London for a local ISP in Tanzania.

Aside from the marine optical fibre link in South Africa and Djibouti, which has access to the SEA -ME-WEA cable, most of the other International connections are carried via satellite, except for the countries having borders shared with South Africa. For these countries, the lower cost terrestrial links and historical ties have resulted in all of the ISPs there connecting to the South African infrastructure.

Because of the high cost and low international bandwidth available in many African countries, increasing attention has recently been drawn to the possibility of using satellites for Internet services using VSAT. It offers reasonably high bandwidth (64K-2Mbps) and substantially lower costs than most PTT supplied international leased circuits. However regulatory barriers have stymied most attempts to use this technology so far, except in Ghana, Uganda and Zambia, where the telecoms market has been substantially relaxed. As a result there are two VSAT-based Internet Service Providers in Kampala - InfoMail and Starcom, and one each in Ghana (NCS) and Zambia (ZamNet). There is also a closed user group link to the University of Dar es Salaam in Tanzania. Public international data communication licenses were recently issued to three companies in Tanzania and it is expected that they will also use VSAT for their services.

The recent availability of the higher powered KU-band satellite footprint in southern Africa, and the prospect of other KU bands being directed at Africa shortly, further improves the potential for VSAT because of the sharply decreased equipment costs for the groundstations which only cost \$10 000 for full two-way transmission capabilities. Within the decade, other satellite-based communication systems being planned are expected to radically im-

prove access from the most remote areas of the continent, but the costs are unlikely to be within the reach of the average African citizen.

Most of the new large scale telecommunication infrastructure building projects which have been announced, most notably AT&T's Africa One which aims to put a optical fibre necklace around the entire continent, have not yet been finalised. However RASCOM has advanced its plans to launch its own satellite in 1997 and the ITU has announced the availability of some funds to assist in improving the most glaring gaps in the PANAFTTEL terrestrial network.

Most countries in Africa have some form of local or internationally hosted web server with varying degrees comprehensiveness but the quantity of information is generally very limited.

The volume of electronic mailing lists and UseNet news discussion groups on Africa has grown substantially, partly due to the number of Africans still on store-and-forward dialup email-only services. The number of African residents outside of South Africa with email addresses is becoming more and more a matter of guesswork, but those who have estimated usually hit around the 5 - 10 000 mark.

Of particular importance for Internet developments in Africa has been the establishment of national cross-sectoral Internet working groups comprising actual or potential Internet access providers, users, telecom operators and government. These groups have been formed in Angola, Ethiopia, Gabon, Gambia, Namibia, Sierra Leone, South Africa and Tanzania. On a related note, in East Africa, the East African Internet Association (EAIA) has formally been registered. It is the first regional grouping of Internet Service Providers, collaborating to improve their service, share resources and ultimately to set up an international hub to share leased line costs.

Of the more important recent events which have helped to accelerate connectivity in Africa was the Addis Symposium on Telematics for Development in April 1995. Africa's largest-ever gathering of computer and telecom experts, it brought together over 250 people comprising representatives from 38 African countries, 31 different African PTTs or Telecom ministries, and almost all of the major forces in International computer networking development projects. The recommendations it produced stimulated the subsequent Conference of African Ministers responsible for planning to instruct the UN Economic Commission for Africa to set up a 'High-level Working Group' to chart Africa's path onto the information highway. Hosted by the Egyptian Cabinet Information and Decision Support Centre in Cairo and supported by Unesco, the ITU and the IDRC, the expert group developed a framework document entitled the African Information Society Initiative, which was adopted at the subsequent meeting of the Conference of African Ministers.

The subsequent Information Society and Development Conference (ISAD) held in Johannesburg in May 96 heightened awareness of the issues further, and also strengthened the developing countries' role in the development of the Global Information Society. However the conference also served to point out how far behind the countries of the South were in being able to exploit the potential benefits of improved use of ICTs, stimulating many to call for drastic measures.

In November 1995 a collaboration between BellaNet, UNESCO, IDRC, UNECA and ITU called the African Network Initiative (ANI) made a study on future information infrastructure building activities in Africa. It identified a substantial number of ICT related development projects being planned or in process in Africa.

Of these, the 16 potentially most influential activities are:

1. The UN Secretary General's System-Wide Initiative on Africa, which includes ICTs as one of the major components in a \$11.5 million programme called 'Harnessing Information for Development' (HID/SiA) supported by the various UN partners.
2. The \$15 million Leland Initiative aiming to provide about \$.5million per country to assist with developing Internet connectivity in 20 African countries in return for agreements to liberalise the market to 3rd party Internet service providers. Assistance is in the form of equipment, expertise, training and free circuits for the first year.
3. The ITU's programme for Africa resulting from the 11 million SFR profits from Telecom95, as well as various rural, community telecentre, health and satellite projects emanating from the Buenos Aires Action Plan being conducted in co-operation with UNESCO, IDRC, WHO and others.

4. The commerce-oriented TradePoint initiatives of UNCTAD which has made Africa the priority region for the next two years. UNCTAD has obtained a commitment from the European Union for ECU 30 million for the regional development of local trade efficiency networks in Africa.
5. Agencies involved with "La Francophonie", such as ACCT, AUPELF and ORSTOM, which made number of large proposals to the Ministerial-level meeting in Cotonou earlier this year to help in building awareness and accelerating the establishment of connections to the Internet in all the Francophone countries in Africa.
6. The multi-donor InfoDev fund being established by the World Bank, which has approved the \$500 000 South African Telematics for African Development Consortium and the \$1 million African Virtual University Project.
7. UNESCO's IIP programme, which has already (with funding from the Italian and Dutch Governments) been executing the RINAF (Research and Information Network for Africa) project in about 10 African countries.
8. UNECA/PADIS are continuing with the IDRC initiated Capacity Building for Electronic Communications in Africa (CABECA) project in 21 African countries.
9. WHO has assisted in a number of telemedicine and health information policy projects in Africa, including support for HealthNet (see below).
10. The Department of Foreign Affairs of the Netherlands is considering funding high bandwidth Internet connections to universities in 8 African countries.
11. UNDP's Africa Bureau has agreed to fund 10 sub-regional telematics policy and sensitization workshops in Africa.
12. UNDP's SDNP is assisting with local telematics network development in Angola, Cameroon, Chad, Malawi, Mozambique and Tunisia.
13. USAID's Productive Sector Growth & Environment Office of the Africa Bureau has launched the AfricaLink project which will fund equipment, training and some communications costs to connect about 100 African institutions to local email service providers.
14. The World Bank's \$15million Regional Environmental Information Management Project for Central Africa which has a large component for linking up participating institutions to local Internet services.
15. UNEP's Mercure project uses VSAT technology to establish an environmental information exchange network in Africa. UNEP is co-operating with the ITU to examine the possibility of using the spare bandwidth of the network for other functions.
16. The European Office for Outer Space Affairs is proposing the COPINE project to donate groundstations and transponder time to African research institutions.

These and over 100 other finalised projects were identified during the study, with others added subsequently in preparation for this report, indicating an unexpectedly high level of activity in this area from the international community.

3.0) Country, Region, Sector and Activity specific findings

Information on country conditions and project activities was analysed in a number of different ways in order to determine the areas of limited support.

3.1) Basic Internet related infrastructure

The first survey ranks the Sub-Saharan African countries according to a range of data-communications criteria related to the development of the Internet. The criteria were: a) Full Internet now or very soon (IP), b) Presence of international Internet link greater than 9.6Kbps (>9.6), c) Presence of low cost store and forward electronic mail services (S&F), d) Presence of a cellular telephone network (CELL). It should be

noted that cellular networks may be important in building demand for Internet access among the elite, but it would not be an answer for the majority, because of the high cost of use), e) telephone density greater than 1 per 100 (LINES), f) local dialup access to Internet in most of the country (NN). g) presence of active cross-sectoral national Internet working group (NIG), h) more than one ISP (>1), i) private sector ISPs (INC), and j) presence of an X.25 packet switched network (X.25).

By assigning one point to each of the criteria and ranking according to the total score in each country, a very rough guide to countries and regions in greatest need was developed. This simple type of analysis cannot identify critical path problems or barriers that may change the ranking of a particular country - these are dealt with in section 4 below, which should be examined in conjunction with the country summaries included in the Appendix.

Also, even the presence of all of these positive factors in a country does not necessarily indicate a lack of need for development - all of the African countries including South Africa, are largely populated with people who have never made a phone call, let alone accessed the Internet.

Conversely, some of the more advanced countries may have more suitable environments for evaluating experiences and developing new strategies which could then be passed on to others. Finally, some of the criteria are dependent on the presence of others (such as local POPs, or bandwidth greater than 9.6Kbps, which assume the presence of an ISP in the first place) and this results in accentuating these differences.

The other major factor not accounted for is the presence of appropriate change actors with which to form effective partnerships. Without these, development cannot occur and so the ability to identify and nurture suitable institutional linkages is a prerequisite, and often the overriding factor in choice of location and strategy.

TABLE 1

COUNTRY	IP	NN	>9.6	S&F	>1	NIG	INC	LINES	X.25	CELL	TOTAL
SOUTH AFRICA	1	1	1	1	1	1	1	1	1	1	10
KENYA	1		1	1	1	1	1		1	1	8
MAURITIUS	1	1	1		1		1	1	1	1	8
SENEGAL	1	1	1	1	1		1		1	1	8
GAMBIA	1			1	1	1		1	1	1	7
NAMIBIA	1				1	1	1	1	1	1	7
COTE D'IVOIRE	1			1	1		1		1	1	6
GHANA	1		1	1	1		1			1	6
TANZANIA	1		1	1	1		1			1	6
UGANDA	1		1	1	1		1			1	6
ZIMBABWE	1			1	1		1	1	1		6
ANGOLA	1			1		1	1			1	5
BENIN	1			1	1				1	1	5
DJIBOUTI	1		1					1	1	1	5
MADAGASCAR	1		1	1	1				1		5
MALI	1			1	1		1		1		5
NIGERIA				1	1	1			1	1	5
CAMEROON				1	1				1	1	4
GABON	1					1			1	1	4
MALAWI				1	1				1	1	4
SIERRA LEONE	1			1	1	1					4
SWAZILAND	1		1				1	1			4
BOTSWANA				1				1	1		3
BURKINA FASO				1	1				1		3
CAR	1		1							1	3
GUINEA	1								1	1	3
ERITREA				1	1						2
ETHIOPIA				1		1					2
LESOTHO						1				1	2
MOZAMBIQUE	1								1		2
NIGER				1					1		2
SUDAN				1					1		2
TCHAD				1					1		2
ZAMBIA	1			1							2
REUNION								1	1		2
BURUNDI										1	1
CAPE VERDE								1			1
SAO TOME AND PRINCIPE								1			1
SEYCHELLES								1			1
TOGO									1		1
ZAIRE										1	1
COMOROS											0
CONGO											0
EQUATORIAL GUINEA											0
GUINEA-BISSAU											0
LIBERIA											0
MAURITANIA											0
RWANDA											0
SOMALIA											0

One of the more immediately apparent patterns discernible from the above table is the large number of countries with less than 3 points - 23 in total, almost half of all the Sub-Saharan countries. Thirty of the 49 countries (61%) scored less than half the available points, with South Africa the only country to reach the maximum, and about 8 countries (16%) scoring no points at all. There is also a predominance of smaller and/or island nations at the lower ranks, but the bottom 24 of the 49 Sub-Saharan African countries still comprises 38% of the total population for the region (226 million of the 591 million total).

The countries scoring no points related to Internet development are: Burundi, Cap Verde, Comoros, Congo, Guinea-Bissau, Liberia, Mauritania, Reunion, Rwanda, SaoTome, Seychelles, Somalia and Zaire.

On a regional basis Central African countries were the worst off at an average of 2 points, followed closely by East Africa at 3 points and West Africa at 3.3 points which indicates little difference between these sub-regions. As expected, Southern Africa was at the top of the league with 4.5 points on average.

3.2) Internet related country studies

To provide an indication of where there is insufficient information to determine Internet related strategy, country studies were tabulated and ranked as shown below. The studies identified were:

- HLWG - The ANI High Level Working Group country studies
- AIF - African Internet Forum country studies
- CARPE - USAID/WRI/CABECA Central African Internet infrastructure study
- SIDS - Small Islands Developing States proposal
- USAID-SADC Initiative for Southern Africa barriers to electronic communications study
- IDRC/ECA - Country reports from CABECA missions
- France - French Ministry of Telecoms Forum Francophonie study
- NRC - Case studies in STI
- DGIS - Dutch Ministry of Co-operation Internet related infrastructure studies for its University capacity building programme.
- CTA - Country studies for the Agricultural Technical Co-operation Unit for the Lome countries
- InfoDev - The World Bank initiated multi-donor programme
- ITU - Reports from its Internet consultancy support
- BMI - Country profiles commissioned by the BMI-Teknowledge market research group.

COUNTRY	HLWG	AIF	CARPE	SIDS	USAID-SADC	IDRC/ECA	France	NRC	DGIS	CIA	InfoDev	ITU	BMI	TOTAL
MAURITIUS				1	1	1	1	1		1			1	6
ZAMBIA	1					1		1	1				1	6
ETHIOPIA	1					1		1	1	1				5
MOZAMBIQUE	1				1	1			1				1	5
SENEGAL	1					1	1	1	1					5
TANZANIA					1	1			1				1	4
GHANA		1				1			1			1		4
KENYA						1			1	1			1	4
UGANDA						1		1	1				1	4
ZIMBABWE					1	1						1	1	4
SOUTH AFRICA	1				1	1							1	4
ANGOLA					1	1							1	3
BOTSWANA					1	1							1	3
CAMEROON			1			1			1					3
CONGO			1			1	1							3
LESOTHO					1	1							1	3
MALAWI						1		1					1	3
NAMIBIA					1	1							1	3
SWAZILAND					1	1							1	3
BURKINA FASO						1			1					2
CAR			1			1								2
MADAGASCAR						1				1				2
NIGERIA						1							1	2
SIERRA LEONE						1						1		2
ZAIRE			1			1								2
BENIN							1							1
CAPE VERDE				1										1
COTE D'IVOIRE						1								1
DJIBOUTI						1								1
EQUATORIAL GUINEA			1											1
ERITREA						1								1
GABON			1											1
GAMBIA						1								1
GUINEA						1								1
MALI						1								1
REUNION				1										1
RWANDA									1					1
SAO TOME AND PRINCIPE				1										1
SEYCHELLES				1										1
SUDAN						1								1
TCHAD						1								1
BURUNDI														0
COMOROS														0
GUINEA-BISSAU														0
LIBERIA														0
MAURITANIA														0
NIGER														0
SOMALIA														0
TOGO														0

The table indicates that over a 100 country studies have taken place, covering, the bulk of the continent, with Southern Africa coming in for the most attention. The countries which appear to have the least amount of information about them are: Burundi, Comoros, Guinea-Bissau, Liberia, Mauritania, Niger, Somalia, and Togo.

3.3) Infrastructure building initiatives

To gauge the level of activity contributing to Internet development, projects were identified which had committed to support the establishment of Internet infrastructure in a particular country and tabulated above. To provide a guide to the degree of activity, one point was again assigned to each project in a country.

The 17 major infrastructure building initiatives with concrete national initiatives identified were:

1. ISP - Existing local ISP startups, either already operating or in the process of establishment
2. IDRC/ECA - primarily the CABECA project funded by IDRC and executed by UNECA
3. ITU - ITU's advisory role to PTTs planning Internet services
4. SDNP - UNDP's Sustainable Development Initiative local host development
5. UNESCO - The RINAF project executed by CNUCE in Pisa, Italy
6. USAID - The Leland Initiative, being executed by USAID
7. WB - The World Bank's national capacity building initiatives
8. ROSA - IDRC Regional Office for Southern Africa's 'Southern Africa Connectivity Programme'
9. CIDA - CIDA Canada's national Internet connectivity programmes
10. DGIS - The Dutch Ministry of Co-operation's capacity building programme for African Universities
11. REIMP - The World Bank's Regional Environmental Monitoring Programme for Central Africa
12. RIO - ORSTOM's Electronic network
13. Syfed - The AUPELF/UREF/REFER collaboration to establish Internet hosts
14. SADC - The Southern African Development Community's regional Internet development programme
15. HNET - Boston, US based Satellife supports the development of a number of HealthNet nodes in Africa
16. WFP - World Food Programme's Deep Field Mailing System host development
17. ODA - UK's Overseas Development Programme.

Although almost all the initiatives listed above have already clearly defined the countries they are involved in, there is an element of inconclusiveness in the table caused by USAID, SDNP and ODA, who may add other countries. USAID may change their existing shortlist for the Leland project, except for Mali and Madagascar, where the projects have already been finalised. Further details of the projects can be found on the BellaNet web site.

COUNTRY	ISP	IDRC/EC	ITU	SDNP	UNESCO	USAID	WB	ROSA	CIDA	DGIS	REMP	RIO	SYFED	SADC	HNET	WFP	ODA	TOTAL
ZIMBABWE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8
MOZAMBIQUE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7
ANGOLA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8
BURKINA FASO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8
GABON	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8
MADAGASCAR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8
MALI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8
ZAMBIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8
CAMEROON	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8
CAR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
ERITREA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
GHANA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
GUINEA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
KENYA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
MALAWI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
MAURITIUS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
NAMIBIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
SENEGAL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
SOUTH AFRICA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
SWAZILAND	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
TANZANIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
BOTSWANA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
CONGO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
COTE D'IVOIRE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
NIGERIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
SIERRA LEONE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
BENIN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
ETHIOPIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
GAMBIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
LESOTHO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
TCHAD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
TOGO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
UGANDA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
DJIBOUTI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
NIGER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
EQUATORIAL GUINEA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MAURITANIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
REUNION	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SEYCHELLES	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SUDAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ZAIRE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BURUNDI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
CAPE VERDE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
COMOROS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
GUINEA-BISSAU	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
LIBERIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
RWANDA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
SAO TOME & PRINCIPE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
SOMALIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0

The table again shows Southern African countries at the beginning of the league, with Zimbabwe at the top of the list at 8 points. Over half the countries had more 4 or more projects taking place, but there were 14 countries with 1 or 0 projects: Burundi, Cap Verde, Comoros, Equatorial Guinea, Guinea-Bissau, Liberia, Rwanda, Mauritania, Reunion, Sao Tome, Seychelles, Somalia, Sudan and Zaire.

3.4) User building projects

To examine the extent of efforts which will build demand for Internet services, projects were identified which aimed to assist groups of users to gain access to the Internet through training, equipment donations and communication subsidies, or to develop local information resources. These were tabulated, again assigning one point to each project in a country.

The projects selected were:

- IDRC-SMME - IDRC ROSA's SMME development project
- COL - Commonwealth of Learning distance education projects
- ACCT - Francophonie
- IGADD - USAID's GHAI programme
- CH-GH-SCHL - Zurich University Ghana Schools Project
- GERMP - WRI's Ghana Environmental Resource Monitoring Project
- CARPE - USAID's Central African Regional Programme for the Environment

- ETHSCI - CABECA assisted Ethiopian Science and Research Network
- WB - World Bank Ghana assistance project
- REWU - FAO's Regional Early Warning Network
- US-EMP - US State Dept Environmental Monitoring Programme
- SIDA - MISANET project to link independent newspapers in Southern Africa
- SABA - Development of FES supported, IPS executed Southern African Broadcaster's Network
- InfoDev - Telematics For Development Consortium executed by the CSIR
- ITU-UN-GH - DANIDA financed ITU-UNESCO library/multi-purpose telecentre project
- GHG - Greenhouse Gas network established for group discussion by UNEP
- GovernNet - Commonwealth Secretariat's Eastern and Southern African Management Development Institute network
- SADC-MP CIDA financed Southern African Member of Parliament networking project
- UNCTAD - Special Programme on Trade Efficiency network
- US-TRADE - USAID's TradeNet
- ITU-WHO - Telemedicine collaboration
- APC - Association for Progressive Communications' Women's Training Programme

A number of these and other projects have future plans to assist users and develop content in various developing countries which may include Africa, but the survey restricted itself to the countries where final commitments had already been made for projects.

Table 4 insert printout from Excell spreadsheet file: User.xls

According to table 4 Tanzania is the most popular country for projects. As expected, the other Southern African countries are again at the top of the list. More interesting is the concentration of projects in relatively few countries - 103 of the 141 national activities (70%) are concentrated in 14 (28%) of the countries.

The countries with only 1 or zero projects comprised 30% of the Sub-Saharan nations - Benin, Burundi, Cape Verde, Comoros, Equatorial Guinea, Guinea, Guinea-Bissau, Liberia, Mauritania, Reunion, Rwanda, Sao Tome, Seychelles, Sierra Leone, Somalia, Sudan, Tchad and Togo.

3.5) Sectors and activities

To provide an estimate of the type of activities taking place and the sectors of society they were aimed at, projects were categorised into a half-dozen major areas under 'activity type' (Table 5) and 'sector of focus', (Table 6) and tabulated accordingly. Where projects fitted clearly into two areas the project was listed under both categories.

TABLE 5	
PROJECT TYPE	NUMBER
Donor/development agency collaboration	2
Local Internet service startup	17
Telecommunication reform and policy development	2
Developing use of ICTs in education	8
Development of local information resources	10
Information sharing and research on ICTs in Africa	14
Internet connection assistance for local organisations	27
National and regional electronic network development	19

Internet connection assistance for local organisations took top position in the activity ranks (28% of projects) followed closely by assistance for national and regional electronic network development - a rather broad category - which comprised 19% of the projects. Local Internet service startups (17%) and information sharing and research on ICTs in Africa (14%) were also popular, leaving only 10% of the projects to deal with development of local information resources and even fewer to focus on donor or development agency collaboration and telecommunications reform and policy development (2% each).

TABLE 6	
PROJECTS BY SECTOR	NUMBER
Rural	2
Religious	1
Media	4
Infrastructure	29
ICTs	15
Health	4
Government	11
Environment/Development	19
Commerce and Trade	3
Agriculture	6
Academic/Research&Education	18

Unders sectors of focus, general Internet infrastructure development was responsible for the largest number of projects - 25% of the total, followed by Environment & Development at 17% , Academic/Research & Education at 16%, the use of ICTs in general at 13% and Government at 10%. All of the remaining categories - Agriculture, Commerce & Trade, Health, Rural, Religious and Media had less than 5% of the projects each.

4.0) Country survey - lessons, problems, opportunities and successes

This section does not cover each Sub-Saharan country equally. Instead it reflects the availability of information generated through the missions of the author, colleagues and contacts. As a result there is substantially more experience available from countries that have already received some Internet development assistance. In this respect much of this information can be seen as case studies which can provide particularly valuable feedback in determining strategies for countries which may be at an even earlier stage of development.

Angola: While the PTT has established a 19.2K Internet access link to the University which will shortly be upgraded to provide a 64Kbps link and has plans to act as the hub for the country, it lacks the financial resources needed to implement a service with national coverage as well as a basic knowledge of how to establish and manage a national Internet facility. The extremely poor state of the telephone network, even in the capital, Luanda, will severely hamper widespread use of the service. The use of wireless technologies would appear to have considerable merit in these conditions.

Angola has one of the few operational SDNP nodes in Sub-Saharan Africa which has also made a novel agreement to enter into full co-operation with the NGO email host AngoNet. A commercial service provider Ebonet expects to establish service as soon as the 64Kbps link is available.

Benin: This country is a typical example of one that has been encouraged to establish an Internet service as quickly as possible, in this case due to the Francophonie Heads of State meeting earlier this year. But because of limited knowledge, urgency and historical ties with the France Telecom, it has obtained its service from France Cable and Radio (FCR) which is one of the most expensive Internet services available.

A private sector company (Secni SARL) has made a good start on developing a web site providing basic information about the country (www.secni.com) and it aims to be an information site for all the countries in the Gulf of Benin.

Botswana: Despite having one of the highest per-capita incomes in Africa, the most advanced telephone network on the continent and a shared border with South Africa, Botswana is likely to be the last SADC country to develop a full Internet service, bar Malawi. The reasons for this are not entirely clear, but one of them is that the PTT (BTC) invested heavily in its X.25 network and has yet to recoup the cost, so providing an alternative service appeared counter-productive. Secondly, it has, since the initial requests started last year, refused to allow the private sector to establish value added services such as Internet access. Furthermore, being deeply involved in a restructuring process in preparation for sale to the private sector, BTC did not appear inclined to be considering new services, especially if investment in them might cause the accounts to look less rosy to investors than otherwise. However it now seems that the PTC has finally changed its position, announcing in August 96 that it was freeing up the market, allowing any company to lease international circuits for resale.

In another interesting development, BTC and Telkom have agreed to waive the packet charges on an X.25 based link established between the CSIR and a local company for the provision of a local dial point for CompuServe.

Efforts have been made in the past through the CABECA project to assist in the development of a local store and forward email gateway with the Internet but this did not come to fruition for two reasons. Firstly, while the University is well equipped to provide access (it has a dialup connection to Rhodes University in Grahamstown and a sophisticated campus LAN) it did not feel that it was within its mandate to provide facilities to external users. Secondly, an attempt was made to establish a service at the Botswana Technology Centre, but the leadership of the organisation was not fully committed to the idea and was subsequently dismissed for administrative irregularities.

With its central location bordering many Southern African countries and an optical fibre transmission system around the whole country, Botswana may in the future be an important transit point for Internet traffic in the region.

Burkina Faso: A full Internet link is planned by the PTT for this year and the University of Ougadougou is one of the potential recipients of Dutch Government support for a high bandwidth Internet connection. However a significant problem is that a large part of the campus, including the School for Informatics, will be moving to a new location 380 kilometres from the capital. Since analogue links are the only type available nationally, a 9.6Kbps connection will be the maximum available, thus reducing the value of the planned high bandwidth link. In addition, as in many African countries, the public telephone exchange serving the campus is saturated, so obtaining more lines for leased circuits or for external users to dial into will be a problem.

Burundi: No known Internet activities.

Cameroon: While being known as a 'difficult' country in which to develop international assistance projects due to internal rivalries and politics, Cameroon is in a good location to support central African regional projects. The headquarters of UDEAC are located there, and the organisation has a keen interest in developing Internet links in the region. Being Francophone and English speaking is also advantageous.

Cape Verde: Little is known about Internet developments in Cap Verde, but it should be able to benefit from recent efforts to establish a Lusophone Internet development assistance project in Brazil. If the planned Senegal-Brazil marine fibre optic cable project is finalised, Cape Verde will most likely be linked to it.

Central African Republic: Civil strife has reduced the impact of the recently launched digital 64Kbps Internet link by the PTT. As a result it is very keen to see projects which will build demand for its service.

Comoros: Virtually nothing is known about this nation's Internet plans, save to say that a representative from the PTT attended the Addis Symposium on Telematics for Development in 1995.

Congo: Strife resulted in the destruction and abandonment of the RIO node in this small country. ORSTOM has indicated that they are interested in re-starting the node, but this has not yet taken place. The President, Pascal Loussaba, is known to be supportive of using ICTs for development.

The African secretariat for WHO is in Brazzaville and it has had considerable difficulty in even maintaining voice connections with its sub-offices around the continent. As a result electronic communication was thought to be an alternative solution and Satelife attempted to install a groundstation at the office. But interference caused by unidentified radio equipment, possibly from Kinshasa across the river caused it to be unusable. Four years later it is in the process of installing a VSAT groundstation, having obtained permission from the ONPT.

The licensing system for VSAT in the Congo uses a novel strategy - the ONPT can be designated as the recipient for the satellite circuit charges, in which case it adds 5% before passing them on to the user. Alternatively, if ONPT is not included in the arrangements, then it requires an annual license fee of about \$8 000, as well as a monthly fee of about \$3 300 where there is no existing telecoms infrastructure.

Because the telecoms network is so poor even in Brazzaville, SITA has developed experience using point to point spread spectrum radio modems to provide permanent circuits for its clients in co-operation with the ONPT.

Cote d'Ivoire: The liberalised market for value added services in Cote d'Ivoire has resulted in two companies moving quickly to establish full Internet services. AfricaOnline, the subsidiary of International Wireless, Boston, set up its second ISP in Africa in Abidjan in August after considerable delays in obtaining the leased international circuit from the PTT, CI-Telecom. Africom Sarl has obtained a VSAT license to establish an Internet service, but has yet to raise funds for purchase of the dish. It is a small Ivorian company started by an early networking champion in Cote d'Ivoire, Joseph Mayega. With the considerable resources of AfricaOnline's multinational parent it is unclear how successful Africom will be in competing against them.

Djibouti: Located in a strategic position in the Horn of Africa, Djibouti has the potential to become an important hub for the region, especially if terrestrial links to neighbouring countries are upgraded. As a member of the SEA-ME-WEA group, it is a connection point for the 20Gigabit optical fibre cable connecting South East Asia with the Mediterranean. The full Internet link currently operated by the PTT could be easily upgraded if regional traffic demanded it and this fits in well with the goals of the Djibouti Chamber of Commerce's EU funded project to assist with commercial ISP development in the 11 Horn of Africa countries.

Equatorial Guinea: No known Internet activities.

Eritrea: This country has substantial potential for successful donor involvement. Its people are highly motivated to rebuild the nation after years of war, and this, combined with its small size means that there is close contact and a high level of co-operation among institutions. There is a government organisation - EISA - which does not have much resources, but is dedicated to improving the use of ICTs in the country. It is actively developing an Internet strategy and preparing an in-depth web site in preparation for when this becomes available.

Ethiopia: With a massive rural population and a limited but reliable telephone network, Ethiopia has a formidable task in developing national connectivity. However it does have an active and broadly constituted national Internet working group, BITE, which has produced the most comprehensive national information infrastructure in Africa plans to date. Unfortunately the PTT does not appear to be particularly willing to devolve any responsibility for building the infrastructure, declaring itself to be the monopoly ISP and requesting other email store and forward service providers to cease operations.

With the large number of International organisations present in Addis - (OAU, UNECA, almost every embassy, etc.), the PTT could derive substantially increased revenues from Internet traffic if these organisations chose to route their non-critical traffic through the public network, rather than using their autonomous private systems.

Gabon: Reports indicate an exceptionally high level of interest in obtaining access to the Internet in Gabon and the country has the telephone penetration as well as the level of income to obtain a significant level of Internet use in the shorter term. The PTT also operates one of the only groundstation hubs on the continent and although limited in power, it could provide low cost downlink access in the central African

region, assuming a high bandwidth connection to the rest of the Internet can be made available. Currently there is a novel joint venture taking place between the PTT and a private company to establish a 64Kbps Internet link and CompuServe service in collaboration with South Africa's CSIR. The UNDP's SDNP project, UNESCO's RINAF and the World Bank's REIMP projects based there could also have a significant impact, especially if they are able to collaborate.

Gambia: A small country with significant potential for improving its use of ICTs, Gambia has a fibre optic trunk running throughout the country, close collaboration between the PTT and government, and a national cross-sectoral Internet working group planning to establish full Internet access across the country shortly. The working group is also noteworthy for its strong emphasis on building local information resources online in parallel with developing the access service. Commitment to entry of private sector ISPs has not been tested, but in such a small country, many small service providers may not be viable.

Ghana: A liberalisation policy started some years ago resulted in early establishment of full Internet facilities by a private company, however the cost of access is high - \$100 a month. A second service provider - AfricaOnline - is due to enter the market shortly which should bring down the cost. Ghana has become a focal point for a large number of international assistance projects, the results of which should be particularly valuable in providing input to strategies in other countries. The basic telephone infrastructure is still very poor, which will tax the effectiveness of many of the planned development projects, and may require extensive use of radio data connections.

Guinea: With the first PTT in Africa to be majority owned by a foreign company (60% by Malaysia Telecom), Guinea will be a valuable test case in determining the validity of this liberalisation strategy. Even before the purchase, the PTT - SOTELGUI - was committed to establishing an Internet service, which is expected by October. One of the driving forces behind the provision of Internet has been the Ministry of Information which has entered into an agreement with CIDA's Electronic Commerce World Institute to establish a web site providing government, business and tourist information. The Ministry of Higher Education and Research operates a point-to-point wireless link between two of the campuses around Conakry which connects the University via a dialup link to the US.

The PTT's Internet development strategy provides a good model for other small or very underdeveloped countries - it is planning to start with a very small service for up to 100 dialup users and four leased lines during the first 6 months of operation using low cost PC based equipment. On the other hand, it realises the importance of adequate bandwidth and is planning to start with a 128Kbps service.

Kenya: One of the countries that was expected to be among the first in Africa to obtain full Internet, efforts to achieve this in Kenya were stymied by the regulatory environment and the high cost of international leased lines. As a result Nairobi has developed the most dense concentration of dialup service providers on the continent outside of South Africa, albeit unofficially. In late 1995 a few full Internet services were nevertheless established, despite the PTTs objections advertised in the national papers. But their efforts appear to have pushed KPTC into its recent liberalisation of the market for third party services, as was the case in South Africa.

Like Ethiopia, the large number of international organisations present in Nairobi, would allow the PTT to derive substantially improved revenues from Internet traffic if these organisations chose to route their non-critical data through the public network, rather than using their autonomous private systems.

The PTT is now in a good position to provide high speed access to the Internet, having just established a national digital leased line service.

Nairobi is also the focal point for the East African Internet Association, the first African regional grouping of infrastructure operators which is planning to develop a shared Internet hub facility for its members in Kenya, Uganda and Tanzania, a model that could readily be replicated elsewhere in Africa.

In an interesting recent development, one of the local ISPs, Form-Net, has offered free Internet accounts for all government departments in return for access to government information to put online.

Lesotho: With relatively low cost optic fibre connections to South Africa it would have been expected that full Internet access would have emerged in Lesotho by now, but this has not yet taken place. This is partly because Internet related development assistance projects have largely concentrated on the University which is 30km from the capital and also because an appropriate organisation interested in hosting a full Internet service has not yet emerged (or identified for support) in Maseru.

Liberia: No known Internet activities.

Madagascar: Surprisingly quick moves on the part of the PTT have resulted in full Internet access in Antananarivo and recent installation of a VSAT network for domestic telephone traffic between the major cities which should substantially improve the potential for national access to Internet in the future. The poor state of the local loop network within Antananarivo and elsewhere which limits access to 2400 baud in most cases will hamper growth of the network. As an indication of the potential low level of use of the new Internet service, the RIO node, which operated for many years as the only email facility in the country, only had about 15 subscribers in August 1995.

Malawi: Dispersed economic and administrative centres linked by low quality trunk routes has limited the critical mass of demand for Internet in Malawi. Coupled with this the PTT has recently invested in an X.25 network and it sees the establishment of Internet services as competition to this. As a result independent store and forward email services operate in Lilongwe, Blantyre and Zomba, with no co-operation between them to share the costs of international calls.

Mali: The first country to accept support from the Leland initiative, Mali will shortly be on full Internet in a novel experiment where a free international link for a year will be provided to private sector service providers.

Mauritania: The University of Nouakchott is the only organisation in Mauritania to have registered its Internet domain, but little else is known about networking activities.

Mauritius: Despite a liberal market for value added services such as CompuServe, the PTT - Mauritius Telecom - holds the monopoly Internet service which is priced very cheaply for Africa- \$10 a month. The Centre Syfed, which is paying \$3300 a month in X.25 charges for its 19.2Kbps circuit to France, is trying to arrange a local link to the local Internet service but Mauritius Telecom is unwilling to allow the Centre Syfed to continue to provide free accounts to its users. In general the regulatory environment for the control of competing services is unclear at present and awaits the reform process which is currently taking place.

Mozambique: The only ISP in the country, the Centre Informatica at the University upgraded its popular service from dialup store-and-forward email to full Internet early last year using an analogue link to the University of Durban. Support from DGIS and World Bank were used in this process along with core funds from a supportive vice-chancellor. With over 500 users, the volume of email occupies much of the available bandwidth, and so full Internet access has still not been opened to the dialup users, and is only available on site at the CIUEM premises. Efforts have been made to obtain a digital circuit to South Africa, but these have only this month become available and there is the ongoing problem of bringing a

digital link the last mile from the PTT switch to the CIUEM premises. So efforts are now being focused on obtaining a digital VSAT connection.

The PTT's joint venture company, TeleData, which has been supplying the dialup X.25 service, is planning to establish full Internet services. It is unclear how this will affect operations at CIUEM.

Namibia: First established at the University of Namibia, the country's primary public Internet service is the only one in Africa to operate as a non-profit foundation - NAMIDEF. There have been some recent private sector entrants to the market, but NAMIDEF has the support of government, NGOs and the academic community as well as many private companies, who all agreed to pay for a year's Internet service in advance to raise the necessary funds to pay for the leased line connection to South Africa. NAMIDEF has established a national plan for expanding the service but it is suffering from lack of full-time staff to support users and expand the service.

Niger: Although UNITAR has been trying to assist with establishing a full Internet connection for the AGHRYMET regional centre there, as yet there have been no developments and the RIO node continues to be the only service available. As with almost all the other RIO nodes, traffic is carried over international X.25 circuits which results in a very high cost for service - about 2FF per page sent or received. Switching to direct dial over the public voice network would reduce costs by approximately 5 times.

Nigeria: Very poor telecommunication and electricity infrastructure has resulted in little progress toward full Internet connectivity. Many organisations depend on voice radios for domestic communications because of problems with the inter-city network. Lagos has a relatively more reliable copper and fibre telephone network, but other cities except Abudja have extremely poor networks. As a result there are a half dozen dialup store and forward services in Lagos but little else except for a recently installed X.25 and leased line service via South Africa's VSAT based SpaceStream facility.

The recently formed Nigeria Internet Group, a non-profit NGO comprising users and service providers, is actively campaigning for full Internet connectivity and has received a \$35 000 grant from RINAF.

Reunion: The University of Reunion has the only Internet connection at present, using a high cost X.25 circuit to France.

Rwanda: The government of Rwanda asked for assistance from UNICEF in establishing a full Internet connection, but after the initial inquiries little has transpired. The telephone network is relatively well developed and could easily support a reliable Internet service.

Sao Tome e Principe: No known Internet activities, see Cape Verde.

Senegal: This country is one of the best models of national Internet access provision - The PTT operates a full dial up and leased line Internet service, but also allows other organisations to lease a circuit from them to resell Internet access. Charges for the dialup and leased line service are low for Africa (\$20 a month for 4 hours a month dialup, and \$2000 a month for a 64Kbps leased line). Of particular note is the availability of access from anywhere in the country at the cost of a local call via a special number service established by the PTT which can be used by any Internet service provider.

With relatively low international call tariffs to Senegal from other Francophone countries in Africa, Senegal could become an important short term hub for dialup store and forward hosts in the region where there is no local Internet and so are currently having to call to the US, the UK and France at much higher rates. While the PTTs service is not equipped for FIDO and UUCP (the protocols of choice for dialup

host networking), ENDA TM's multiprotocol host is able to handle all such traffic and is already doing so for NGO hosts and HealthNet nodes in Burkina Faso and Mali.

Senegal is also home to PANA which has recently established the RAPIDE project which aims to provide Internet access and local web based information resources in every African country. PANA has signed a continent-wide agreement with SITA to provide connectivity throughout the continent, and a prototype national web server has been developed for Senegal (www.rapide-pana.com). The server includes facilities to connect real-time audio streams for broadcasting national radio onto the Internet and a field test has been carried out between Senegal and Washington. When the bandwidth becomes available PANA will add real-time video streams. Currently PANA is looking for local partners in African countries to take a 45% investment in the operation of the local service.

Seychelles: No known Internet activities.

Sierra Leone: The PTT is committed to establishing full Internet services as soon as possible, but has not yet selected a supplier. The country may qualify for support under the Leland Initiative which could determine the choice of supplier, but at present it has not decided whether to allow third party resale of its Internet service, which is a binding requirement of Leland.

Although Sierra Leone has an extremely poorly maintained local loop infrastructure, (even in Freetown where cross-town connections are generally not reliable above 2400 baud on many circuits) it does have digital leased links to secondary towns. Even more surprisingly, the PTT - Sierratel - has ISDN facilities in Freetown, although it took an ITU consultant on an on-site visit to the main switch to discover that it had ISDN capabilities, unrecorded on any of the company's equipment inventories.

Somalia: No known Internet activities.

South Africa: Being in the top 20 countries worldwide for the number of Internet hosts, South Africa has developed a substantial amount of experience in this area. A vibrant Internet user community was first established some years ago within the academic community, who were the only ones with local access to full Internet. A number of store and forward dialup services operated for the NGO community and computer enthusiasts, and some businesses used CompuServe (before it had full Internet). As more of these services sprung up, it appeared that Telkom had agreed not to apply the letter of the law regarding third party resale, and around the same time UniNet relaxed its membership policies a little, allowing the NGO email service provider (SANGONet) to become the first non-academic/government system on full Internet in South Africa.

Shortly afterward, Intenet Africa and Internet Solution established the first full Internet commercial services. Being ahead of the worldwide 'switch-on' to Internet they were in a position to gain the bulk of the market as the trend picked up. Nevertheless, a couple of years later there are almost 50 independent ISPs currently in the country, including a number of multinationals, some of whom have bought large shares in local companies. With so many service providers, a segmentation of the market can be observed - there are the premium services which provide more international bandwidth and more modems per user, and the smaller, cheaper services which have slower links and fewer modems per user.

The academic network, UniNet, continued to administer domain name registration for the whole country for many years, despite its repeated calls for the private sector to take on the task. Nothing happened until UniNet declared that it would start charging for domain name registration. This resulted in a flurry of discussion and the eventual appointment of the Unix user group - UniForum - to take over the process and it has run smoothly since then.

Since the beginning of the year Telkom has been offering a dialup and leased line Internet service under beta test, and the leased line service was recently launched with a novel pricing system - a low cost service (for less than \$1000 a month) which provides 64Kbps nationally, but only 16Kbps on the International link, and a high priced service (\$4000 /month) for a full 64Kbps on the international link. This, combined with a rapid roll-out of national POPs which eclipses the commercial service providers offerings, resulted in the formation of an association of ISPs which has brought Telkom before the Competition Board for exploiting its monopoly position on the supply of basic telecom infrastructure.

The case is unresolved at present but it seems that retaining the monopoly on international data traffic is resulting in Telkom laying itself open to attacks such as that from the Internet Service Providers Association (ISPA), who rest the bulk of their case on cost of access to international circuits. Paradoxically, the monopoly on international circuits is also having a negative effect on Telkom's potential revenues, since companies such as Transtel are restricted from bringing in traffic from the rest of the African continent into South Africa where it would then use Telkom circuits.

While costs of access are generally affordable in the major cities due to the presence of local POPs, there is no low cost method of access outside of these areas. Access through cellular phone and Beltel (the videotex service with a 800 number) have reduced costs and expanded the area of coverage a little, but has not brought costs down to anywhere near the levels of those with local dial access. The telephone network is also very under-developed in many of the rural areas, especially in the former homelands.

The topology of South Africa's Internet consists of 6 'top-level' operators with their own international leased line Internet links which service dialup users as well as a number of 'secondary' ISPs who share the international bandwidth of the top-level ISPs. The local links (peering points) between the ISPs under different top-level providers are rare and those that do exist are of low capacity, which results in very slow response times when users of an ISP of one top-level provider attempt to connect to ISPs on a different top level provider. This is because the traffic must either travel through local links which are usually overloaded, or because the traffic must travel across the international links to the US and back. UniForum has established a no charge peering point available to all ISPs who wish to use it but competitive pressure seems to have discouraged its use, at the expense of users who can wait many minutes to download a single page from another site across town.

International connections even from the US and Europe are often no better - there are many instances where users in the US and Europe have written to say they have given up trying to access web pages on ISPs in South Africa because the response rate is too slow. Since this is also the case for most attempts to access the web sites of other African countries from South Africa, it is clear that substantial efforts must be made to improve sub-regional linkages if there is to be any serious Internet based information exchange in the region.

South Africa also has an active cross-sectoral national IT working group (NITF), but its scope is perhaps too broad to allow it to focus intensively on developing national Internet strategy.

With its low-cost international leased lines to neighbouring countries, and excess telecoms bandwidth on the fibre link to Europe and the US, South Africa has become the Internet hub for the sub-region. Although some of the surrounding countries can only provide analogue links, SA is likely to expand its role further into the continent with the two VSAT groundstation hubs in operation - one by the PTT Telkom and the other by the transport parastatal, TransNet, which operates a satellite communications subsidiary - Transtel.

Telkom's VSAT hub will be used to upgrade the analogue link to digital for the ISP in Zambia. Transtel is currently barred from bringing third party traffic into the country but is unofficially providing a non-commercial Internet link from the South African academic network (UniNet) to the University of Dar es Salaam in Tanzania.

The South African parastatal research and development group CSIR has developed a very active marketing programme toward the rest of Africa and one of its ICT departments - InfoTek - has signed up agents in 9 African countries (Gabon, Mauritius, Zimbabwe, Swaziland, Botswana, Malawi, Mozambique, Kenya and Egypt) for its WorldNet Gateway, CompuServe and WorldNet Africa Internet information service products. The WorldNet gateway product allows offline access to major commercial databases on the Dialogue system, cutting access costs by 75%.

All of the agents are also being supported by the CSIR to develop full Internet connections in order to supply the WorldNet Africa Web-based value added Internet service. Currently the major focus has been on selling CompuServe, but there are only about 500 users in total across all of the above systems, partly reflecting the high cost of using such 'value added' Internet services. The Mauritius hub plans to provide CompuServe and Internet to the Indian Islands and the Kenya hub plans to provide links to 8 other East African countries.

Sudan: There may be potential to develop the existing collaborative project between the University of Gezira, GreenNet in London and the University Partnerships Programme implemented by McMaster University Canada to expand connectivity to other universities in the country. The telephone infrastructure has apparently improved considerably, at least in Khartoum if not in the north.

Swaziland: The telecommunications network has improved substantially in Swaziland, allowing 28.8Kbps connections from most urban locations. The PTT not been concerned with establishing an Internet facility itself but has encouraged UUNET Africa to set up a service. With support from RINAF and CABECA, the University of Swaziland has been in a position to link to the Internet for some years but there has been insufficient commitment from the top level executive. As a result the lecturer in computing science most involved with the project formed a private company with some local partners and set up the UUNET franchise in Mbabane. This month however, the University finally commissioned a link to the UUNET node which is installing an additional analogue circuit, using a different route, as a backup to its existing digital 64Kbps link to Johannesburg.

Tanzania: Although undergoing rapid modernisation, the very poor telecommunications infrastructure in Tanzania is a significant barrier to the spread of full Internet services which are being developed by at least 5 groups - the University of Dar es Salaam, SITA, Twiga (a Tanzanian company), Wilken (a Nairobi based company) and the PTT (TTCL) following the liberalisation of the telecommunication sector.

Because of the poor quality of the local loop, Twiga have used cellular telephone modem adaptors for its users to dial in to. This would not have been viable if the PTT had not priced calls from the terrestrial network to the cellular network at the cost of a normal local call. This arrangement is not a perfect answer - the switches between the terrestrial and cellular networks have been minimally dimensioned and can easily become congested.

The economic union of Kenya, Tanzania and Uganda has resulted in telecommunication links between these countries not being tariffed at international rates. This could encourage the development of sub-regional Internet links between ISPs in these countries, especially since the EAIA (See Kenya) has an active Tanzanian membership. Surprisingly, telecommunication links in northern Tanzania (Arusha) are more reliable to Kenya than to the capital in the South. As a result, the store and forward email host there con-

nects daily to Nairobi rather than to Dar es Salaam. This situation may persist for leased line traffic when full Internet becomes available.

Tchad: Despite the very limited telecommunications network, there is strong support for Internet development from the local store and forward hosts which will likely benefit from the SDNP project underway there.

Togo: Little is known about Internet developments in Togo, but there is an active RIO node and the possibility of an SDNP project.

Uganda: With the most extensive liberalisation of telecommunications in Sub-Saharan Africa and a rapidly growing economy, Uganda is receiving a lot of attention from the international community. The open market has allowed the two commercial ISPs to establish the first high bandwidth VSAT based Internet services in Africa and their experiences should be valuable for others wishing to establish similar systems. As virtually everywhere else in Africa, however, Internet access is concentrated in the capital. Like Tanzania, Uganda may also be a good testing ground for the development of sub-regional links in East Africa due to the low tariffs on leased lines to Kenya.

Zaire: A virtually non-existent telephone network poses serious problems for any networking development project in Zaire and the development of wireless solutions is likely to be necessary. There are three organisations keen to be involved in the establishment of some form of Internet service - PATU and two private companies - CIFOR and Telecel. Also, the World Bank's REIMP project may provide some resources to help establish Internet access in Kinshasa.

Zambia: A liberalised telecommunications sector and a forward thinking regulatory authority has resulted in innovative Internet service provision in Zambia. The skill and dedication of the director of Computer Services at the University of Zambia combined with support from the World Bank led to the HealthNet/Esanet project being steadily built up into a the first Sub-Saharan full Internet provider outside South Africa - ZamNet. It was established as a private company by the University, who is the major shareholder and provider of the premises for the service, and given a license by the regulatory authority. Subsequently, other entities have applied to become ISPs but the regulatory authority has refused on the grounds that it would threaten the viability of the existing ISP, given the small and emerging nature of the market.

The regulatory authority has also been supportive of ZamNet's efforts to obtain more bandwidth. Quite soon after the service started, its 9.6Kbps analogue link to South Africa became saturated and the PTT cannot yet provide digital links outside the country. ZamNet then obtained permission from the regulator to operate a 64Kbps VSAT link to South Africa and began the process of installation. Over a year later the dish has still not been installed due to various delays obtaining further clearance from the PTT (required by Intelsat because the Zambian PTT is a signatory) and logistical problems in shipping the dish from the US.

The telephone network outside Lusaka is very poor and ZamNet continues to operate its original FIDO based service for many organisations outside the capital who find this is the only reliable way to access email services.

Zimbabwe: This country also provides many valuable insights into the process of Internet growth in a developing country. In 1990 a co-operative of local and International NGOs established MANGO - the first store and forward email gateway to the Internet in Sub-Saharan Africa outside South Africa. Used as a model for many of the other early store and forward systems in Africa, the non-profit service grew quickly to the point where there are now over 250 users accessing the service through a single phone line using the highly efficient FIDO protocol. Despite the recent emergence of full Internet services, MANGO continues to operate successfully as a low cost alternative for those whose primary requirement is email. Due to the provision of premises and some support staff time by SARDC (a local NGO) and the dedication of the various system operators, the system provides the lowest cost access of any unsubsidised email service in Africa.

A number of other dialup store and forward systems have started at the University of Zimbabwe (Zimbix, EsaNet and HealthNet) and another NGO based service, ToolNet, operates in Harare. With demand for full Internet services steadily growing, three private companies have been able to obtain analogue leased circuits from the PTT to three different South African ISPs. There are a few informal local store and forward hosts outside the capital, one of the ISPs has attempted to obtain a leased line to Bulawayo for many months and the new National University of Science and Technology (NUST) has received RINAF support to establish a connection.

The services have all been operating unofficially due to the restriction on the resale of telecommunications services, but because of the critical mass of users (about 2000) with the presence of many large companies, government departments and international NGOs, the PTT has not felt able to crack down, especially since it cannot yet provide an alternative. But recently the PTT signed with Sprint to establish a large scale national Internet infrastructure and it is possible that the private services may be requested to cease public operation (as is the case in Ethiopia), or be forced out by the more competitive pricing, higher bandwidth and nationally accessible service provided by the PTT.

The current situation in Harare for full Internet users is also an indication of a likely scenario in many African countries, that should be avoided if at all possible. The popularity of the services combined with the competitive environment which discourages co-operative sharing of available bandwidth and local peering between ISPs along with the high cost of International circuits and lack of digital high speed links, has resulted in severely congested services. Throughput from web servers in the US (where local bandwidth is unlikely to be a problem) averages 20 characters per second (compared to at least 500cps in South Africa), even at 4am in the morning, which makes any form of browsing unrealistic except when there is a predefined need to download a specific page.

5.0) Conclusions

5.1) Country specific findings

Clearly, almost all Sub-Saharan African countries require significant levels of support in most areas.

There is a need to gather more information about activities in some countries, but assuming that the reason for the lack of information is lack of activity, then the list of countries, that are repeatedly at the bottom of the tables described above are (in order of population size):

Zaire, Sudan, Niger, Rwanda, Somalia, Guinea, Burundi, Benin, Tchad, Sierra Leone, Togo, Liberia, Congo, Mauritania, Guinea-Bissau, Cap Verde, Equatorial Guinea, Reunion, Comoros, Sao Tome, Seychelles.

Zaire and Sudan, with 44 million and 30 million people respectively, are way ahead of any of the other countries in terms of numbers of people without the prospect of any form of Internet access. Because of their very large populations and limited levels of development assistance, Ethiopia, Cameroon and Nigeria are suggested as countries which should be added to the shortlist. Reunion and the Seychelles are very small and relatively rich countries likely to find their own resources, so it is suggested that these be removed from the list. This results in the following shortlist:

Nigeria, Ethiopia, Zaire, Sudan, Niger, Rwanda, Somalia, Guinea, Burundi, Benin, Tchad, Sierra Leone, Togo, Liberia, Congo, Mauritania, Guinea-Bissau, Cap Verde, Equatorial Guinea, Comoros, Sao Tome.

Prospects for success in these countries vary considerably, and for many of them there is insufficient information currently available to make a clear evaluation, however it is possible to add some further comments over and above those in section 4 above:

Nigeria: Aside from the infrastructural deficiencies, the political situation presents a severe problem. There are opportunities however to build on the work of the Nigerian Internet Group, RINAF and the World Bank, as well the large number of store and forward hosts that have built demand. The development of a shared access hub may also be a possibility. A digital link (up to 2Mbps) can be supplied to Lagos through Telkom SA's SpaceStream facility, which would keep more of the traffic within the continent and enhance regional information exchange (due to the improved response times on Internet connections which would not have to travel via slow links to the US). VSAT connections may also be necessary for cities outside the capital and wireless solutions may be needed for the local loop.

Solar/Battery backup systems may be required to deal with the power problems in some areas. Shared public access facilities/telecentres will clearly be necessary as so many are without computers.

Ethiopia: The BITE group is a strong platform upon which to build an assistance project. Problems with the PTT need to be resolved to allow third party service providers but it is possible that the 'carrot' of the Leland project may assist this process, along with the efforts of the BITE group and UNECA. Capacity to supply digital links within Ethiopia needs to be developed, either through an upgrade of existing equipment or through use of VSAT. Also, high capacity digital circuits to Djibouti's SEA-ME-WEA link would ultimately be the desired route to the Internet.

Zaire: In a similar situation to Nigeria, but with even worse infrastructure and more strife, Zaire will be a difficult environment to work in. There is also no national Internet working group or clearly defined entity that could assist with developing this capacity as yet, except perhaps PATU. There are some organisations which could host an Internet service, and co-operation with the REIMP, UDEAC, WFP and MAF initiatives may result in the development of a successful project which would encourage other development agencies to become involved. VSAT connections are very likely to be necessary, again potentially supplied by South Africa or perhaps Gabon, but the bandwidth out of Gabon is likely to be insufficient in the medium term.

Sudan: The political situation is also a problem in Sudan. More information is required on the plans of the PTT but the HealthNet and University of Gezira dialup Internet links show there is demand that could be built upon.

Niger: AGHRYMET has a strong need for connectivity which UNITAR has been trying to find support for with little success so far, although it is possible that UNEP may provide assistance under the UnepNet programme. Further information is needed about the PTT's plans and the regulatory situation.

Rwanda: The Government is known to be interested in developing connectivity but more information is required on PTT plans.

Somalia: Possibly a too unpromising country to work in, but there is insufficient information to make a final conclusion.

Guinea: The prospects for success in Guinea are relatively good. The PTT is rapidly modernising and committed to providing Internet but it needs to be convinced of the need for third parties to resell the service. The Ministry of Education could convert its dialup University link to full Internet and the Ministry of Information /CIDA Web project could be expanded to other ministries.

Burundi: Clearly a difficult situation to work in at present.

Benin: With the limited number of projects in this country, efforts should be made to build demand for the PTT's Internet connection.

Tchad: Additional information is necessary on any national plans, but it may be possible to build on Tchad SDNP project.

Sierra Leone: Very similar comments to Guinea. Strife has clearly dissipated from the bulk of the country, there is potential need to build demand for the PTTs service and to be able to make use of the digital links to cities outside the capital. SierraNet and national Internet working groups are a good institutional basis for a project.

Togo: Appears ready for Internet access, further contact with Syfed and the PTT is necessary.

Liberia: Most likely an impossible situation to work in at present.

Congo: Strife and poor infrastructure will be problems, but there is support from the President for developing connectivity, although the recent closure of independent media throws this into question.

If activities go ahead under the REIMP project there may be some potential for co-operation.

Mauritania: Possible collaboration with the University of Nouakchott.

Guinea-Bissau, Cape Verde, Equatorial Guinea, Comoros, Sao Tome: No known activities, further research needed although Cape Verde and Sao Tome may become involved in the Lusophone networking project discussed in Brazil earlier this year, and Equatorial Guinea could perhaps obtain assistance from Spain.

5.2) Sub-Regional specific findings

To gain a more general picture of national and sub-regional variations, points for user and infrastructure building projects were totaled which showed that the two types of initiatives closely parallel each other. Dividing the totals into groups according to geographic sub-region and then taking the average number of points per country showed that at 12 points per country, Southern Africa was the recipient of more than double the number of projects compared to any of the other sub-regions, whose differences were relatively insignificant. Central Africa was the next with 5.6 points per country, followed by East and West Africa with 4.5 and 4.4 respectively. The difference between the Southern sub-region and the rest is accentuated by their respective population differences - Southern Africa has only 21% of the Sub-Saharan population while the West has 35%, the East 33% and Central is the least populated with only 11%.

Dividing the countries according to the Four language groups - French, English, Portuguese and Spanish showed that English speaking countries had almost double the average number of projects per country (9) than the French or Portuguese speaking areas with 4.95 and 4.8 respectively. The sole Spanish speaking country - Equatorial Guinea had 2 points. For comparative purposes, 45% of the Sub-Saharan African countries are Francophone (22), 43% are Anglophone (21), 10% are Portuguese and 2% are Spanish (1). However by population, 66% of Sub-Saharan Africa is Anglophone, 29% Francophone, 5% Portuguese and less than 1% Spanish speaking.

It is hard to draw any firm conclusions from the region specific findings except of course the expected result that most of Southern Africa appears to be much better covered than other regions. On the basis of population figures it would seem that West Africa and East Africa are more in need of assistance than Central or Southern sub-regions. On a language basis the proportion of projects appears more well balanced when the population figures are taken into account.

In planning regional or sub-regional projects a consensus appears to be developing from experience to date that it is more effective to work on building regional networking once strong national networks have been developed, rather than to attempt to establish regional networks first. Support which is specifically directed toward the end users of networks is often the most effective approach to building strong national and regional networks. The level of computerisation and ICT literacy is usually so low that projects which focus on a more top-down approach at national and regional strata with the various umbrella organisations that operate at these levels, are often unsuccessful until the underlying userbase has been sufficiently developed.

The use of geographic regions for the focus of user assistance projects is often a rather arbitrary method since electronic networks of users are usually not restricted by geography but more by cultural and language groupings.

It should also be pointed out that the proximity of North Africa and its largely superior telecommunications infrastructure should not be ignored. A number of East and West African countries have borders with North African countries that could influence the nature of a regional infrastructure support project.

5.3) Sector specific findings

The use of the Internet and ICTs in general cuts across so many sectors in such a pervasive way that developments for one sector should apply to many others as well. Often it may simply be that local information sharing between sectors is the barrier to the spread of available practices. Nevertheless most public sectors are still badly in need of support for obtaining computer equipment and even telecommunication cost subsidies initially, with government departments often the most badly lacking.

The tables and charts indicate that there are already a substantial number of activities aimed at the development of Internet infrastructure in general and the use of ICTs, as well as in the Environment/Development, Academic/Research and Government sectors, although these by no means cover the bulk of the continent. Also, the large number of projects in these areas indicate that there is probably room for increased collaboration and co-ordination between the agencies supporting these projects.

This is particularly the case for the emergency/relief sector, which was not identified separately in the study, but comprises separate activities by DHA, UNHCR, WFP, IFRC, US Dept of State/ReliefNet and many relief and crisis support NGOs, (CARE, Medicins Sans Frontiers, MAF). This sector in particular is responsible for establishing a large number of independent infrastructural links. Cross-sectoral co-operation between projects operating in different sectors is equally important and because developments can cut across so many sectors.

Given the low level of urbanisation in Africa, the minimal number of projects aimed at rural communities is a distinct deficit which has also been identified recently by the FAO. With the importance of commerce and trade it is also surprising that there are so few projects in this sector. Agriculture, health, and the media are also relatively poorly supported and there appears to be substantial room to develop projects with partners such as CTA, CGNET, HealthNet, WHO, and UNESCO.

Improved support for media networking organisations such as MISA and IPS would seem to be particularly important and perform an important role in sensitising the public and decision makers around the AISA and improve the exchange of information between countries and regions.

Cultural, youth and gender oriented projects relating to the Internet appear to be virtually absent and no projects were identified in the labour and trade union sector. The latter is particularly surprising given the relatively well developed national, regional and sectoral union structures that are present in many African countries. It would appear that a project involving the Organisation of African Trade Union Unity, its members and affiliates such as the Southern African Trade Union Co-ordinating Committee (SATTUC) and na-

tional federations present in many African countries is needed. A lot of information already passes between unions and their respective International Trade Secretariats (such as ICEF, IMF, and PTTI) concerning health and safety etc that could be expedited by Internet connectivity.

A project involving PTTI (Post Telegraph and Telephone International) and post and telecom workers unions in Africa may be particularly relevant given the rapid restructuring taking place in the post and telecom sector. A project involving a women's trade union group such as the ASATUW Forum may also be appropriate, given the lack of gender oriented activities.

More generally, it seems that a re-orientation could take place in some of the guiding strategies behind efforts to accelerate Internet development in Africa along sectoral lines. Many projects are aimed at developing the local markets for Internet and the capacity to use them inside the country, but building the capacity to exploit the huge potential of the far more extensive information economies of the developed countries appears to go unnoticed.

Also, the emphasis on infrastructure development needs now to be balanced by the more far-reaching issues around content, intellectual property and preservation/exploitation of cultural heritage. While the infrastructural issues appear more simple to solve, the dialogue around content/infostructure issues is at a much lower stage of development. In particular, mechanisms to ensure the ability of Africans to protect and exploit their intellectual property in the GII remain undeveloped, as do the techniques for developing information facilities which would attract western consumers.

5.3) Priority unfulfilled needs and opportunities for improved Internet development in Africa

Among the most important unmet needs identified that were generally required in many of the countries were:

1. Synthesis and promotion of the existing country studies and research in the countries not yet covered to provide more detailed information to determine strategy and to learn from existing experiences. Related to this is the need to put in place on-going mechanisms for countries to share experiences.
2. Developing access points and building demand in secondary cities and rural areas by training users, supporting them with equipment and installation subsidies, as well as through the establishment of shared community telecentres and promotion or support for wireless link alternatives where necessary.
3. Support for technical training to induct new host system operators and to upgrade the skills of the existing ones using store and forward technology. Directly related to this is the need to gather system installation and maintenance documentation in French and Portuguese. Aside from financial assistance for holding individual training sessions and national training workshops, identification and promotion of low cost training centres in more advanced African countries such as South Africa and Egypt is needed. Due to the high travel and subsistence costs, regional training workshops are perhaps a less appropriate option unless they are combined with an International conference.
4. Support for administrative and business skills upgrading for small service providers.
5. Support for the establishment of local cross-sectoral national Internet working groups and technical assistance for them to develop national NICs, Internet infrastructure plans and an inventory of local resources. These groups could be related to any existing IT or ICT working groups, but not be subsumed by them, unless there is some clear committee structure that focuses on Internet planning and information exchange between all sectors.
6. Promotion of information on low cost alternatives for setting up Internet/Intranet hosts to all sectors, but especially to SMME's interested in setting up public access Internet drop-in centres and to computer systems suppliers. This would aim to counter the barriers caused by the general perception of high

- costs, and include information on development of basic business plans or cost recovery methods for different scales of service.
7. Encouragement for the development of sub-regional links in general, and particularly between culturally or economically connected neighbouring countries.
 8. Technical assistance to the telecom operators for improvement of the bandwidth of local loop infrastructure - through promotion of innovative methods for upgrading existing copper circuits from analogue to digital (such as ADSL) and using wireless links where necessary.
 9. Identification of sources of support for local initiatives from existing regional and global projects (see for example the EU and G7 Information Society pilot projects discussion below) along with support for project proposal development.
 10. Identification and promotion of sources of low cost and second hand computer hardware and software, such as the equipment supplied by CODE Canada, as well as training to maintain the equipment.
 11. Identification of sources of soft finance for local business startups and international partners willing to invest in joint ventures, such as African Business Consultants.
 12. Support for the establishment of an African centre for administration of IP addresses, autonomous system numbers and continent wide directory services, like the AsiaNIC, RIPE and the InterNIC.
 13. Support for increased collaboration of international assistance projects in order to build strong local hosts and improve the effectiveness of other Internet related projects.
 14. Technical assistance to ISPs to improve reliability through the implementation of redundant links and dialup backup systems.
 15. Technical assistance ISPs to encourage use of methods to reduce congestion of international links through installation of caching servers and mirror sites.
 16. Support for analysis of traffic patterns to assist in network topology planning, size of bandwidth provision and pricing mechanisms to spread usage more evenly over the day.
 17. Promotion of the use of digital satellite data-broadcasting to reduce congestion on leased line circuits and even to provide high bandwidth data services to end users in KU band footprint areas.
 18. Assistance with the evaluation of the alternative proposals for Internet services provided by the private sector in the tenders of public bodies.
 19. Assistance with obtaining preferential treatment for public sector users from ISPs, such as the FormNet model in Kenya and Intelsat's allocation of satellite channels for education.
 20. Encouragement of some national governments to reduce import duties on ICT equipment.
 21. Technical assistance to national, provincial and municipal governments to implement Intranets and to move their existing data from standalone systems to open networked systems.
 22. Identification and promotion of modem brands which operate best on low quality telephone lines susceptible to lightning.
 23. Assistance to organisations with legacy LAN systems such as Lantastic and IPX, and legacy WAN systems such as Zoomit, Compuserve, Lotus Notes and some cc:Mail implementations to move to open Internet/Intranet based facilities.
 24. Encouragement of international agencies to use local ISPs for non-critical traffic instead of using their autonomous systems for all communications.
 25. Assistance with development of procedures to protect local intellectual property rights and cultural heritage rights.
 26. Assistance with training and the development of low cost systems for the rendering of cultural artifacts for placement in web museums. (Possible co-operation with the ESPRIT MUSA project and NRC Canada).
 27. Promotion of the new developments in web/http server protocols to deal with email-only access, low bandwidth and/or wireless connections - e.g. HTTP-NG, Agora email to web gateways etc.
 28. Promotion of improved interfaces for the non-literate and less educated such as text to voice output, touch screens, webTV, voice recognition, and improved machine translation facilities for major languages.

29. Support for the use of special equipment for the disabled, such as braille keyboards and voice cards for the blind.
30. Encouragement for the establishment of content building service centres (possibly attached to ISPs) which can provide web site development and training, advice with establishing organisational web servers for small and medium sized organisations and other related content development areas such as audio/video servers and CD ROM mastering facilities.
31. Support for African participation in the ongoing process of development of international intellectual property protection policies, information law, policing and the technical mechanisms for ensuring their adherence.
32. Sensitisation of 'conservative' decision makers to the possibilities for using the Internet.

5.4) Evaluation and Research Needs

There are a large number of other areas where it will be particularly important in the short term to gather further information to be able to properly fulfill an Internet development support role and to guidance strategy in the development of new assistance programmes.

IDRC could assist in the evaluation of:

1. The existing national case studies and pilot projects which urgently need to be assembled to provide examples to others of what should or should not be done, and to be able to evaluate the appropriateness of the various choices
2. The different operational and tariffing models for scaling Internet services to the national level (i.e. peak/offpeak/traffic charges and local call number vs national POPs centrally maintained, vs franchised local ISPs) and for sharing international and local bandwidth between different entities. A model to be looked at could be the Ebone which appears to have become a Europe-wide WAN to which all members have access.
3. The competing marine fibre optic cables around Africa options which are being proposed and their integration into RASCOM and other satellite initiatives.
4. Opportunities to benefit from increased involvement in the G7 Information Society Pilot Projects.
5. The different inventories of African Internet resources currently being maintained - Network Startup Resource Centre (NSRC), Gondwana, ITU, AfricaLink - and possibilities moving to a single reference source, possibly in collaboration with the G7 Global Inventory Project. Related to this would be to evaluate ways to represent the data graphically and also to develop indicators of quality of the communication and information channels. Technology criteria (e.g. circuit bandwidth), and accessibility criteria are fairly well developed relative to content criteria.
6. Opposing or overlapping regional or sub-regional Internet infrastructure building initiatives: the CSIR's VSAT project, DGIS's VSAT project, The Leland Initiative, ACCT/Centre Syfed, RINAF, SpaceTel, DIANA, MERCURE, COPINE and RAPIDE.
7. The different VSAT groundstation hub facilities in Gabon, South Africa, Egypt and Uganda for use in providing Internet connections.
8. The 'value-added' Internet services such as CompuServe, AmericaOnline and Prodigy which are now aiming to spread through Africa vs the 'vanilla' services operated by local companies who don not have the marketing resources. This could also be related to evaluating encouragement for local content development and to the role of the PTTs. The latter clearly needs further exploration and it is possible that a workshop comprising a top level manager and a data technician from every PTT in Africa may be valuable to familiarise them with new developments, share experience and discuss Internet development plans in their country.

9. The impact of Telkom SA's monopoly on International traffic from the rest of Africa which restricts its use as a hub for the region.
10. Opportunities and mechanisms for private sector/public sector partnerships in Internet related initiatives such as the South African Technology Outreach Programme.
11. Opportunities for exploiting Africa's position in the international timezones - Given that network performance will be slower than desired for some years to come, regional time zone advantages could be exploited in access to time dependent bandwidth improvements - e.g. mornings good in Africa for accessing the US. African countries to the east and west of Europe are likely to have further advantages besides low wage costs. In this respect since Africa is equidistant from the Americas and Asia, it can exploit needs for 24 hour operation, with jobs being passed around the globe, from the Americas to Asia and then to Africa as the day progresses.
12. The usage of existing ISP services - composition of users, structure and composition, including type of usage - time spent online for email vs web access, quantity of data transfers, regularity of usage and the types of information that are accessed from their local web servers. This could also assist in the promotion of simple methods that are needed by ISPs to monitor usage.
13. Software compression tools accessible to users and ISPs and the transfer protocols in use - e.g. FIDO, Taylor UUCP, POP and IMAP.
14. Offline/email interfaces to the web and database access.
15. Trends in Internet service provision where the market has been liberalised to allow the large multinational ISPs to gain entry. This could also be related to evaluating encouragement for local content development.
16. The alternatives for assembling a low cost, user friendly, administratively simple Internet terminal unit which could be supplied to existing community access 'telephone shops' to provide Internet access for their customers. This could be related to evaluation of the variety of shared telecentres currently being established, including those of the ITU, UNESCO, PostNet and the Learning Network Corporation's Digital Community Utilities (DCUs) in South Africa.
17. The information resources currently available on the Internet in Africa and elsewhere with the aim of identifying those with relevance for different sectors in Africa - rural, health, environment etc.
18. The utility of lower bandwidth multimedia communication tools such as Internet based phone, video conferencing and radio/television broadcasting. Related to this would be to evaluate the wide variety of recommended standards for the bit quality of images, video and audio files for use in Africa.
19. Mechanisms for improving the circulation of information about non-commercial software, systems and information resources - most of the available information is provided by the marketers of commercial systems (including most technology publications). This results in inadequate information on low-cost, shareware or public domain software most appropriate to the African context. Particular needs in this area include operating systems, email and web interfaces, multimedia authoring tools, databases and privacy/encryption technologies. Related to this is evaluating the restraint on market development for support created by commercial software. For example Microsoft etc. usually provide representation for only one or two companies who will tend to keep the business to themselves as much as possible - free software may mean users can choose who to get support from, thus creating a far larger market of smaller players specialising in supporting perhaps only a few clients.
20. Common data storage standards and interchange formats to improve information exchange between different information systems and to allow the co-operative updating of centralised databases. For example guidelines on the most appropriate GIS data formats to use and techniques for exchanging data between different systems.
21. The utility of centralising the maintenance of certain information resources. Curiously, the development of reliable national and international networks can make centralisation of some information gathering and delivery services more appropriate, especially in an African context where the availability of skills is so low.
22. The potential for the development of new systems for distributed Usenet news servers which do not require broadcasting the full Usenet news feed which can be 200MB a day - a huge load across the bandwidth starved networks in Africa.

23. The utility of online discussion fori and web sites as ways of improving the flow of information assistance agencies in North America and Europe about activities in Africa.
24. Opportunities for exploiting archives of existing multimedia material (such as from the National Film Board of Canada and the BBC) for storage and retrieval via the Internet, also of archives as a pool of raw material for dissection and re-application of images and sound for educational, cultural and entertainment purposes, especially in science, art and history programming.
25. Local institutional deficiencies in the provision of technical skills and training requirements to provide the human resources needed to build low cost Internet/Intranet access and web-site building services.
26. The viability of developing and maintaining web-based information services through local and international advertising.
27. Opportunities for the establishment of 'information brokers' to sift through the information resources on the Internet for the extraction of information relevant to the broker's constituency.
28. Opportunities for improving the efficiencies of public sector administration through use of the Internet. (e.g Tax returns, registration, payment of fines, rates, information queries.)
29. Opportunities for Africans to market their skills (or even data entry services) to developed country information markets via the Internet.
30. The multiplicity of technology assisted distance education systems and proposals for Africa such as the Telematics for Development Consortium, UNISA, the African Virtual University, GLOSAS, AGN and Gilat/Telkom.
31. The software/hardware alternatives for installing low cost shared demand-dial PPP connections on LANs in organisations with needs for temporary access to the Internet such as a Linux server or Mach2/IProute/Nethopper and Novell Unix server.
32. Opportunities to collaborate with radio and television broadcasters to improve their use of Internet in gathering material for programming, and to use the Internet to increase their listenership, especially in areas of high expatriate populations who would not otherwise be able to receive local broadcasts.
33. Opportunities for small ISPs to develop agreements for reciprocal roaming/temporary account facilities, drop-in usage and access to value added services such as distributed fax servers and private conferences.
34. Ways to encourage regulatory authorities to relax restrictions on the use of wireless options where appropriate.
35. The needs of the PTTs for establishing advanced data communication infrastructures such as ISDN and Frame Relay to support growing bandwidth demands.
36. The technical, administrative and regulatory requirements for security measures such as in payment systems and data protection..
37. The possibility of establishing a CUSO-type volunteer system for placing computer science graduates with Internet skills in organisations in Africa.

5.4) Opportunities for collaboration with other assistance agencies, partners and projects.

5.5.1) Increase the amount of support

While there are a few large projects planned by some donors, the funds available are still relatively limited compared to the degree of need, especially for basic infrastructure building. Many large groups have still to be convinced of the need for such projects and other donors may not yet be aware of the opportunities. In particular, national development assistance agencies should be approached in the UK, Germany, Scandinavia and Asia (Korea, Singapore and Japan) as they have not been as much in evidence in this area as would be expected. To this list should be added many of the private foundations - Soros, Agha Khan, MacArthur, Rockefeller, Ford and the African regional and sub-regional multilateral finance organisations.

5.5.2) The EU Regional co-operation funds

A personal interview with the EU Chef du Mission in Sierra Leone indicates there are large amounts of unused funds in the EU's Lome IV budget for Regional Indicative Programmes (RIPs) for improving regional co-operation. Partly motivated by the EU's goals for its own regional integration, the EU's representative believes that a project involving support for Internet development in Africa would fit very well within the Lome IV regional co-operation programme and that such a project would have little difficulty in qualifying for such support. Improving communications has already been identified as a priority area for RIPs.

The project would need to involve more than one country and make a case for improving economic, social or cultural integration between them. The countries should be part of some existing regional grouping - i.e. a project to link a country or countries in southern or eastern Africa with countries in west Africa would be unlikely to be accepted, although a pan African project involving all countries could fit within the separate budget for ACP-wide projects.

The largest problem is obtaining the support for such a project from all the countries involved. A government representative from each nation would have to be identified and these representatives would then need to jointly agree to nominate one of the group to act as the representative for the project as whole. A means for launching this process would need to be identified. The next UNECA meeting of the African Ministers for responsible for economic and social development and planning, to held in Addis Ababa in May 1997 may be an opportunity to initiate this process as a follow-on to the African Information Society Initiative (AISII) established at the 1996 meeting.

5.5.3) G7 Information Society pilot projects

Some of the G7 pilots will shortly begin to show results such as in the use of wireless technologies and environmental monitoring which could be used in Sub-Saharan Africa. There also appear to be a number of opportunities to participate more directly in the pilot projects which are now open to non-G7 countries as well as public and private organisations. Participation principles stipulate that projects should not create new institutions or bureaucracies, and that they should use funds from existing programmes. ISAD focused attention on the importance of developing country participation, but as yet it is unclear to many DCs how they can benefit by involvement at this stage. InfoDev has been suggested by the G7 steering committee as one avenue for participation but many existing and planned donor projects could be fitted into the theme areas and donors could increase their collaboration on developing country related activities.

Almost all of G7 pilot initial theme areas appear to have relevance in Africa and many of the themes have emerged in the discussions above. Some of the important aspects of the themes are summarised below:

1. *Global Inventory Project*. Creation of an electronically accessible multimedia inventory of information regarding major national and international projects and studies relevant to the promotion of the global information society. An assessment of social, economic and cultural factors impacting on the GIS' development will also be undertaken. African nations could use this as the basis for developing national inventories.
2. *Global Interoperability for Broadband Networks*. This theme has an industrialised country orientation but recently guidelines for participation of non-G7 countries were developed. Carriers could be involved in providing bandwidth to Africa.
3. *Cross-Cultural Training and Education*. Aims at developing innovative approaches to language learning, especially for students and SME's and an objective is to ensure that a 'Global Server on Transcultural Education and Training' - TEL*LINGUA - should be accessible at low cost from low band-

width infrastructures. The EU is currently funding a 9 month feasibility study and a consensus conference planned for 7-8th October. Close co-operation with themes 2, 5, 4 and 8 is expected and a developing country component is now envisaged following ISAD.

4. *Electronic libraries.* Using existing digitisation programmes to create a distributed virtual collection of humanity's knowledge.
5. *Electronic Museums and Galleries.* To accelerate the multimedia digitisation of collections and to ensure their accessibility to the public and as a learning resource for schools and universities. It appears that any focus on the development of low cost tools for rendering are lacking in this theme at present.
6. *Environment and Natural Resources Management.* This projects aims to use the global information infrastructure to help people in developing and industrialised countries find and use information on key environmental and natural resource issues. The two main target areas are climate change and biodiversity. Desertification and other issues may also be considered. G7 members announced an increased collaboration with developing country members to demonstrate the Global Information Locator (GIL) at ISAD. GIL is the prototype virtual library of globally distributed electronic web sites. It is aimed to demonstrate the breadth of information that is already available internationally. The next meeting on the project is 25-26th Sept in Tokyo
7. *Global Emergency Management.* To enhance the management of emergency response situations, risks and knowledge by developing a global emergency management information network (GEMINI). Simon Fraser University is already a participant with its VEMIS system, as is Emergency Preparedness Canada, Spar Aerospace and the Canadian Forest Service.
8. *Global Healthcare Applications.* To demonstrate the potential of ICTs in the field of telemedecine and to promote joint approaches to issues such as the use of data cards and standards. The project aims to develop a prototype Global Public Health Network to assist public health authorities, as well as a 24-hour Multilingual Global Telemedicine Surveillance and Emergency System, a key aim of which is to link the system to the world-wide satellite-based distress communications system.
9. *Government On-Line.* Aims help exchange experiences and best practice use of on-line information technology in electronic administrative business between governments, companies and citizens. A Government On-Line Resource Centre is being established on the web, and at ISAD, videoconferencing between experts in the developing and developed worlds was demonstrated.
10. *Global Marketplace for SME's.* To help develop an environment for exchange of information and to demonstrate the interoperability of services such as EDI on a global scale. The SME requirements theme of the project will address some particularly relevant systemic issues such as 'ownership (intellectual property rights, copyrights etc.), privacy and security, interoperability, deployment (marketing, education, training etc.), globalisation (including multilingual capabilities and multi-cultural systems) and financial aspects (billing, taxation etc.).
11. *Maritime Information Systems.* To integrate and enhance environmental protection and industrial competitiveness for all maritime activities by means of using ICTs. MARIS is keen to guarantee a global approach to this project and is inviting all interested maritime parties to become involved in the project which plans to access funds through the European 4th Framework Programme.

5.5.4) The FAO and IFAD

These organisations have recently become more aware of the importance of providing network access in rural areas and to the farming community. As a result there may be considerable room for collaboration in this priority area.

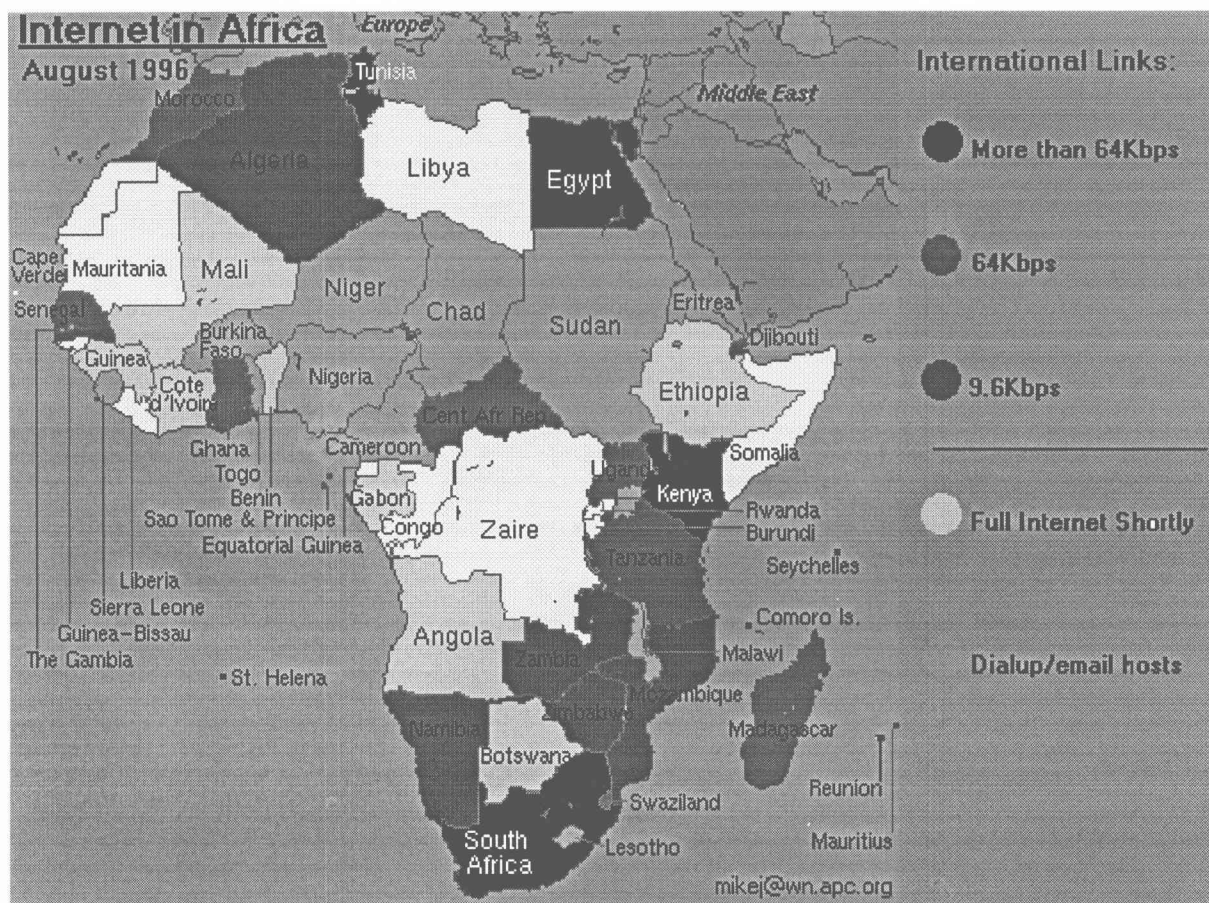
5.5.5) Potential Canadian Partners

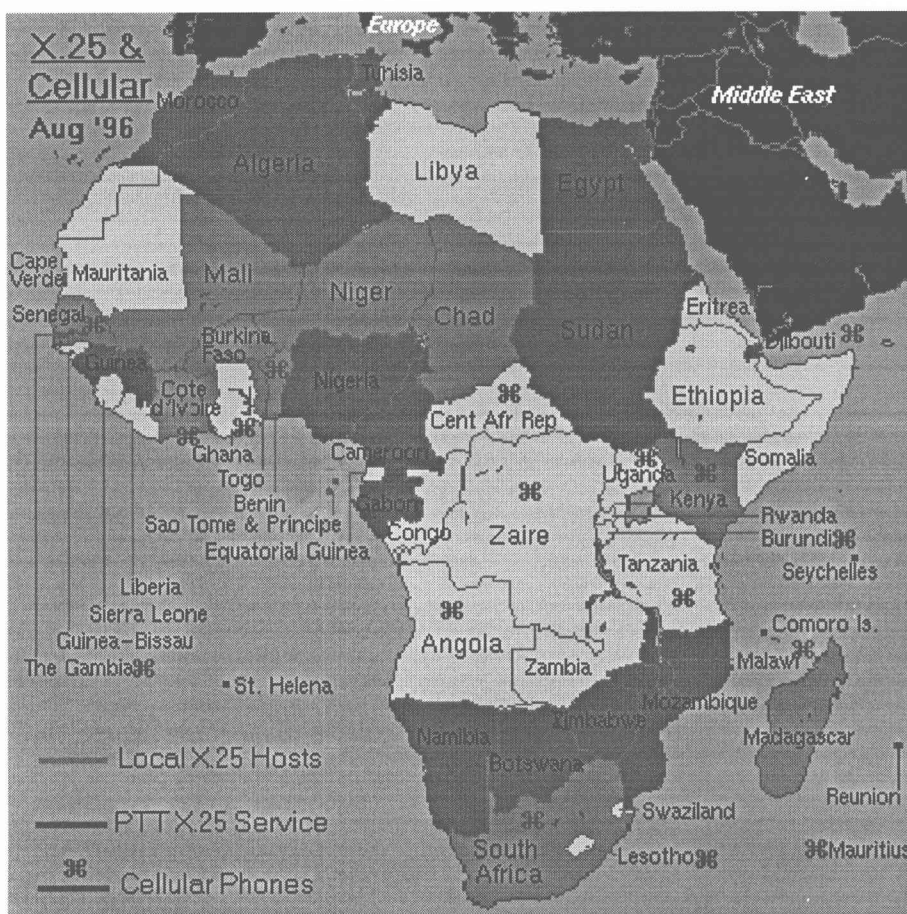
There are many Canadian organisations that have developed skills and experience that could be used in developing collaborative projects with IDRC. These include:

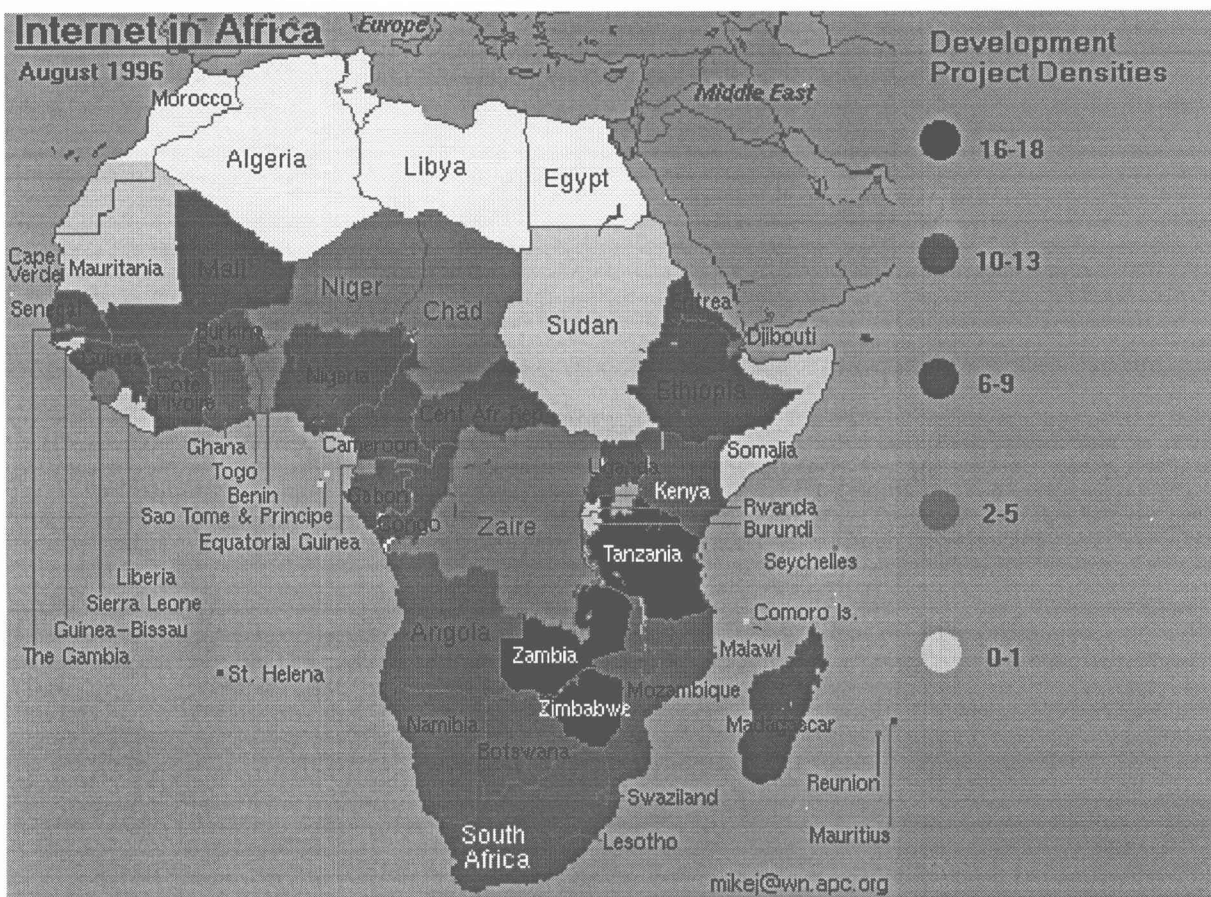
- a) Distance education and training- RITA,/TeleEducation NB, The Virtual-U/TeleLearning Research Network,
- b) Telecommunications and wireless options - Astrocom, Simon Fraser University's EPIX project, Communication Research Centre (CRC) Canada.
- c) Internet bandwidth supply - Stentor, Teleglobe Canada.
- d) Regulatory, tariff and universal access issues - CRTC, Heritage Canada.
- e) Labour networking - CLC.
- f) Health - Telemedicine/TETRA at Memorial University.
- g) Telecentres - Fast Forward Technologies, St John's, Newfoundland.
- h) Cultural artifact rendering - Institute for Information Technology, NRC Canada.

Appendix 1

Maps







Appendix 2

Country Profiles

Country: ANGOLA

URL: www.angola.org/angola

A war-devastated infrastructure has resulted in very few serviceable links outside the capital city. Inside the capital the telephone network is workable but it is difficult to obtain new lines and many exchanges are running at over capacity, resulting in a poor call completion rate. An analogue cellular phone network is in place and taking up slack from the public network. The PTT - Angola Telecom - has just finalised negotiations with Global One, the Internet service provider in the US, to bring a 64Kbps connection to Luanda by September. An Internet working group at Telecom Angola is busy nailing down the final details of the service. The facility will be established in co-operation with the University of Angola which is providing the router/server and will be one of the primary initial users along with AngoNet, the NGO non-profit email provider.

AngoNet and the SDNP local services are co-operating to provide the only currently operational email link to the Internet. AngoNet applied for a VSAT license but were refused. The World Bank Southern Africa Bureau is interested in developing an Internet extension project here.

Country: BENIN

URL: www.secni.com

Benin has a workable telephone network, an X.25 service and an Internet service provided by the PTT, as well as an operating RIO network. The PTT, OPT, launched its Internet service shortly after the Cotonou summit of Francophone states in April, calling it BeniNet. Also a joint venture with France Cable and Radio, which provides the 64Kbps link to Paris, BeniNet claims over a 100 dialup users and an active community building web sites.

The service is accessible through a local call in Cotonou and Porto-Novo for a charge of about \$7 USD an hour. There are a number of leased line users as well, such as SECNI which is building a Web site focusing on the Gulf of Benin and the countries of West Africa.

Country: BOTSWANA

URL:

Botswana has the most well developed telephone network on the continent - a fibre optic ring around the country and 100% digital exchanges. Most Internet users dial direct to Johannesburg. The University dials Grahamstown in South Africa to service its internal needs. Institutional problems at the Botswana Technology Centre have resulted in little progress with the CABECA project there.

The Botswana Government has been planning a leased line direct to the US for Internet services and the SADC Secretariat has installed a Unix server to link its constituency in the region. An X.25 network exists but is too expensive to use for international traffic. Botswana Telecom recently liberalised the market for third party service provision and it is expected that a private sector service provider will be established shortly.

Country: BURKINA FASO

URL:

Burkina Faso has a limited telephone network with an X.25 service, an operating RIO/ORSTOM service and active co-operation between ORSTOM and INTERAFRIQUE and the academic sector.

Country: BURUNDI

URL:

No information.

Country: CAMEROON

URL:

In Cameroon, growth in the use of ICTs is hampered by the poor telecommunication infrastructure which is unable to keep up with demand for new lines. Import and ICT licensing fees are prohibitive. There is an X.25 service, RIO node and a Centre Syfed as well as an active store and forward electronic mail host - Camfido, with over 100 subscribers, many from the Ministry of Health and health related NGOs, reflecting the initial support for Camfido by HealthNet. An SDNP project is also in active development.

Country: CAPE VERDE**URL:**

No Information. Portuguese PTT known to be active in Lusophone countries regarding Internet

Country: CENTRAL AFRICAN**URL: socatel.intnet.cf**

CAR has a limited telephone network and it is extremely difficult to obtain new telephone lines. Trunk routes support between towns and internationally supported dialup Internet connections. ITU is sending a consultant to prepare a rural telecommunication plan under BAAP 9.

The national PTT - Societe Centrafricaine de Telecommunications (SOCATEL) launched its Internet service in April. Also using a 64Kbps link to Paris, SOCATEL's service had attracted about 35 users by July, with about 3 being added every day before the recent strife there which reduced activities somewhat.

Nevertheless plans are already afoot in this small country of just over 3 million people and 7 000 phone lines, to increase the bandwidth to 128Kbps as the current 64Kbps is viewed as insufficient to provide a rapid service for the growing user base. Leased line services are also planned, as Compuserve and other companies have already requested these facilities.

There are no X.25 lines in CAR, but SOCATEL plans to install them in collaboration with France Telecom. The packet switching network will be called CENTRAPAC. Once installed, SOCATEL will not provide virtual circuits to the public. Instead, it would concentrate on RTC services, and making X.25 services available through RTC.

Country: COMOROS**URL:**

No information.

Country: CONGO**URL:**

Congo has a very limited telephone network and it is difficult to obtain new phone lines. Improving the use of ICTs has the support of the President, Pascal Loussaba. Civil strife caused the shutdown of the RIO service but ORSTOM is interested in finding a partner to help reinstate it. Inmarsat dialup Internet links have been successful. A restructuring process is being carried out currently to create two separate entities: Societe de Telecommunication de Congo (SOTELCO) and Office de Postes (OP).

The ONPT has two digital exchange centres and one analogue exchange centre. Another digital exchange centre is going to be installed by Siemens in the near future. There is no X.25 line in Congo. A study was carried out by the International Telecommunication Union (ITU) in 1992 for the installation of X.25 and the ONPT is currently a re-evaluation of the study, to see if the service could be implemented once the restructuring process is over.

Country: COTE D'IVOIRE**URL: www.africaonline.ci**

Cote d'Ivoire has a rapidly liberalizing telecoms environment and a relatively well developed telephone network with an X.25 service. The World Bank system provides a low bandwidth full Internet link to environmental group NESDA and AfricaOnline is one of the first of 3 or 4 private sector Internet services to establish itself.

Country: DJIBOUTI

URL: www.intnet.dj

Djibouti has a well developed telephone network and X.25 service. The national PTT - La Société des Télécommunications Internationales de Djibouti (STID) - set up a 64Kbps full Internet service in May 96. Currently there are only about 30 users, but registrations are expected to pick up after a marketing drive. As a coastal country along the Red Sea, Djibouti has access to the SEA-ME-WE1 20Gbps undersea optical fibre cable that travels from South East Asia to the Mediterranean. This gives it the potential to establish a very high bandwidth connection to the Internet. To exploit this capability, Le Centre Serveur Télématique Régional (CSTR) was set up this year in Djibouti by the Chamber of Commerce to provide Internet based information services to 10 countries in the region.

Country: EQUATORIAL GUINEA

URL:

No information.

Country: ERITREA

URL:

Rapidly modernising telecoms network, active store and forward service at Asmara University, at the Department of Energy and the Eritrean Information Systems Agency (EISA) which is the national government body concerned with ICTs.

Country: ETHIOPIA

URL:

Ethiopia has a relatively reliable telephone network but it is extremely difficult to get new lines. The PTT is not allowing third party use of leased lines and so is currently stifling initiatives by a large and active user base to obtain full Internet connectivity. Having made its own plans to set up full Internet services in the country, the PTT has ordered other service providers to shut down. The Bringing Internet To Ethiopia (BITE) proposal is one of the most substantial NII proposals in Africa to date, having been developed by a national cross-sectoral Internet working group of the same name.

Country: GABON

URL:

Gabon has a well developed telephone network as well as a low power VSAT based domestic network and an X.25 network. Gabon has the world's fourth highest telecoms revenue per inhabitant. In Gabon, which has had its X.25 service for a number of years, full Internet connectivity is expected this month (September 96).

The Gabon PTT - Télécoms Internationales Gabonaises - chose its International Internet service supplier in June. MCI won the bid, apparently on the basis of cost. The bandwidth of the 64Kbps link to the US is expected to be increased as demand grows in this relatively rich African country of 1 million inhabitants and 32000 telephone lines. In particular, demand is expected to be heavy from the recently established micro-informatics industrial park. Gabon will also be able to use its VSAT groundstation hub to allow relatively low cost connectivity for users outside the capital of Libreville.

Country: GAMBIA

URL:

In Gambia, the national PTT - GamTel - has just established an Internet working group to map out a strategy for establishing a country-wide service in this tiny country. GamTel already operates a CompuServe facility using its X.25 network.

With a modern fibre backbone serving the major cities, GamTel plans to establish local high speed POPs to provide national coverage. It is also co-ordinating closely with information providers to build local traffic when the service becomes available.

There is also an active HealthNet service.

Country: GHANA

URL: mantse.ncs.com.gh

Ghana's telephone network is still in a poor state of development but a fully liberalised telecom sector has seen a number of new telecoms and Internet services established, with one full Internet system linked to the

UK and plans by AfricOnline to set up Internet services. The Association of African Universities supplies dialup connectivity to the Universities in Ghana. A large number of International projects are focusing on Ghana.

Country: GUINEA

URL:

Guinea has a very underdeveloped telephone network but does have an X.25 service. The Guinean PTT - SOTELGUI - recently sold a 60% share of its business to Telecom Malaysia. With the new injection of capital and rapid modernisation plans, SOTELGUI plans to offer a dialup and leased line Internet service by September. It is currently negotiating with AT&T for Internet service provision using one of its existing digital satellite circuits to this US carrier.

Once a digital circuit can be established between the satellite earth station and SOTELGUI's main office premises in Conakry, the dialup service will be opened on 8 lines to start with. Demand is not expected to be more than 100 users and 4 leased lines during the first 6 months of operation. SOTELGUI plans to start the service with a 128Kbps connection to ensure that its service is fast and can cope with the anticipated growth in user base.

ORSTOM is also planning to expand to a full RIO node in Conakry.

Country: GUINEA-BISSAU

URL:

No information.

Country: KENYA

URL: www.africaonline.ke

Kenya's telephone network has improved substantially of late, and the PTT - KPTC - has recently established a national digital leased line service. Nairobi has a large number of store and forward Internet service providers (some unofficially hubbing off UNEP's permanent X.25 link to the Internet via Norway). Most of the service providers have joined the very active East African Internet Association (EAIA) which is planning to establish a hub for the many smaller service providers who wish to share the costs of an international link.

Four organisations - ARCC, AfricaOnline, Form-Net and ICRAF - have obtained leased line links to the US. Local access for users outside the capital is not available except in Mombasa and via the X.25 network.

Country: LESOTHO

URL:

Lesotho has a steadily modernising telephone network and an active store and forward service at the University which is in Roma, 30km away from the capital, Maseru. The PTT is supportive of establishing a private sector Internet service in Maseru but currently most Internet users access a dial in point in Ladybrand on the South African side of the border, maintained by Lesotho Office Supplies. The World Bank's Southern Africa Bureau is planning an Internet development project in Lesotho.

Country: LIBERIA

URL:

No information.

Country: MADAGASCAR

URL: dts.dts.mg

The telecommunications network in Madagascar is in a very poor state of development. The quality of existing lines and access to new lines is a severe limiting factor for the use of electronic communication services.

Nevertheless, Data Telecom Services (DTS), an affiliate of Telecom Malagasy, launched its full Internet service in April 1996. With a 64Kbps connection to France Cable & Radio, the service already has over 250 dialup users. Shortly, the service will be connected to Madagascar's X.25 packet switching network, Infopac, for leased line access and dialup facilities in cities outside of the capital, Antananarivo.

There are also about 15 users of the local RIO/ORSTOM node housed at the Centre d'Information et Technique et Economique (CITE), a French Government funded international institution. Access is obtained through one direct dial link and 4 SVC's on an X.25 circuit for direct links to France and for connection to Infopac. An X.25 link is also used to connect the Centre Syfed's web site to the Internet via a connection to France.

Country: MALAWI

URL:

Malawi has a poor telephone infrastructure with unreliable links between cities and congested international circuits. An active local store and forward service is hosted by the University in Zomba and there are also two private sector store and forward service providers, one in Lilongwe and another three in Blantyre.

World Bank Southern Africa and SDNP are in advanced stages of planning Internet projects in Malawi but this may conflict with the recently launched X.25 service of the Malawi PTT.

Country: MALI

URL:

Mali has a very limited telephone network, but there is an X.25 facility and an active RIO service as well as a private sector store and forward service provider and a HealthNet node. Little is known about the Internet service plans in Mali by the PTT - SOTELMA. However, it has confirmed its participation in the Leland Initiative - a USD \$15 million project of the US government to assist with Internet connectivity in 20 African countries where the market has been sufficiently liberalised to allow third party ISPs.

Country: MAURITANIA

URL:

The University of Nouakchott is in the process of establishing a full Internet connection.

Country: MAURITIUS

URL: www.refer.mg

Mauritius has a far better telecommunications infrastructure than most other countries in Africa. As part of its national strategy to become the 'Singapore of Africa' it has made telecommunications and data services a high national priority and this is reflected in the availability of ISDN services in some areas, relatively short waiting times for the installation of new telephone lines (especially for businesses) and a rapidly emerging range of data communications services such as Internet, X.25 and EDI. Three SDH fibre optic rings have been built in Mauritius to improve the local telecom infrastructure and to provide a high bandwidth connection to the main groundstation in Port Louis.

The people of Mauritius were the first in Africa to see their PTT - Mauritius Telecom (MT) - get into the ISP business. In a joint venture with France Telecom, MT set up its Internet service provider late last year as part of their subsidiary company, Telecom Plus. The service provider at the French side of the 64K link is France Cable et Radio (FCR). MT has also just upgraded their X.25 link to France to 3x64 Kbps.

Free dialup access was given to users for many months of testing, but in March this year it opened officially. The rates for a dial-up PPP connection (28.8 Kbps modems) are: US\$ 9.52 / month, US\$ 0.07 / min, between 07:00 - 19:00, US\$ 0.05 / min after 19:00 and there is no volume charge.

Permanent 64K leased line connections to the server will also be provided, as well as 19.2K analogue circuits. Local 64K circuits are priced at about US\$750/month with international circuits at US\$15 000/month (for both ends) and local 9.6K circuits at \$250/month. A license is needed from the Mauritius Telecom Authority for resale.

Other services include:

1. A national and international X.25 service operated by Mauritius Telecom Services.

2. Compuserve, email and X.25 based link to the WorldNet Gateway service of the Council for Science and Technology (CSIR) in South Africa operated by The Export Processing Zone Authority which is also developing web services.
3. An EDI, data, and electronic mail service operated by Mauritius Network Services (MNS).
4. The University of Mauritius operates a FIDO link to South Africa, a UUCP link to the UK and a French supported AUPELF/REFER/Centre Syfed X.25-based full Internet node has been recently installed on campus.
5. The Centre Syfed-Refer offers heavily subsidised access to non-commercial users as well as a web page hosting Mauritian academic and research institutions for free.

At present the University of Mauritius is in the process of establishing an ethernet WAN/LAN to link all of the buildings on campus, however the independent research centres on campus such as MSIRI and FARC are not currently part of these plans. Because the University and the research centres have independent administrations, the only body that can make policy on this issue is the higher level Mauritius Research Council (MRC).

Country: MOZAMBIQUE

URL: www.uem.mz

Limited telephone network but rapidly expanding infrastructure. Direct dial access is available from most major centres (using VSAT links to Intelsat) and a full Internet service operates from the University covering all sectors. An X.25 service is available in Maputo with links currently being installed in Beira and Nampula. The PTT's subsidiary TeleData is known to be planning an Internet service.

Country: NAMIBIA

URL: www.net.na

Namibia has a relatively well developed telephone network and X.25 service. A full Internet service provider - NAMIDEF - operates in Windhoek as a non-profit foundation providing facilities to all sectors, including government. Currently all users must dial directly to Windhoek, but as volume of traffic grows, additional points of presence will be added.

The X.25 packet switched network, called SWANET, has local access points in Windhoek, Swakopmund, Oshakati, Tsumeb, Keetmanshoop, Luderitz and Otjiwarongo. Although reasonably priced for national connections, the international service is very expensive - about 3 times the price of a direct dial call.

Some telephone exchanges in Namibian towns are still manually switched via an operator, making data connections virtually impossible.

As plans to establish a terrestrial telecommunication link to Angola and Botswana progress, it may become feasible to interconnect the three countries' Internet service providers.

Country: NIGER

URL:

The Niger telecoms network is a poor, analogue system with 12 international channels to France, but there is an X.25 service. The RIO node is in service using dialup - not on the X.25 network. There is an emerging ISP - Gama Informatique - connecting to his.com in the US.

Country: NIGERIA

URL:

Nigeria has a very limited telephone network. Only 4 to 5 cities have IDD, but a packet switched X.25 service exists via Telkom SA's VSAT based SpaceStream service to South Africa and further data services to link the major cities for data communications is in process. While SpaceStream can supply a digital link to Nigeria, there are no digital services inside Nigeria, which restricts bandwidth to 9.6Kbps.

Most universities have radio links and rely on telex. There are about 30 Universities and 25 colleges in Nigeria, of which about 20 have large computing facilities. The World Bank is looking at the feasibility of establish-

ing a Universities network linked to the Internet. There are at least two private sector store and forward service providers in Lagos.

Country: REUNION

URL:

No information.

Country: RWANDA

URL:

Rwanda has a relatively good telephone network. The government is thought to be planning a full Internet service.

Country: SAO TOME AND PRINCIPE

URL:

No information.

Country: SENEGAL

URL: senet.net

Having prepared for privatisation for some time, Senegal's PTT, Sonatel, has a reasonably well developed telephone network. Public telephones maintained by the PTT have been abandoned in favour of telecentre bureaux operated by small businesses. Sonatel also operates an X.25 service and a full Internet service. There is also an active NGO oriented Internet service, and the ORSTOM/RIO service provides links for the academic community.

The launch of full Internet access in Senegal by Sonatel was initially met with scepticism over its ability to provide a well supported, reasonably priced service which allowed other players to enter the market. But these fears have failed to materialise - prices are low, the service is reliable, and other Internet Service Providers (ISPs) are free to enter the market.

Sonatel provides a 64Kbps international link to the global Internet via a satellite circuit to the United States provided through MCI's managed Internet service. With about 400 users already, the popularity of the service and reliability requirements are now leading Sonatel to negotiate with a second service provider to provide a second circuit via France Telecom or possibly Teleglobe Canada which has rates 60% cheaper than many other providers.

Sonatel's dialup service is only 10 000CFA (about USD20) for the first 4 hours a month and 1200CFA (about USD2.5) per hour after that. On top of this, the service is available at the cost of a local call anywhere in the country.

To accomplish this Sonatel has established a special telephone number prefix (28-), which their accounting system uses to eliminate long distance tariffs. While this may result in some loss of telephone call revenues, it undoubtedly encourages the use of their service and eliminates the need for the extra hardware, leased lines and maintenance that would be required to provide local points of presence (POPs) in other city centres that would be necessary to set up a truly nationally accessible service. For rural areas which would still be a long-distance call away from any city centre, this facility is a real breakthrough, virtually unknown anywhere in the world. Surprisingly, this local call facility is also being made available at no extra charge to the other service providers now beginning to enter the market such as ENDA Tiers Monde - a large non-governmental organisation based in Dakar.

Country: SEYCHELLES

URL:

Inactive RIO service.

Country: SIERRA LEONE

URL:

Sierra Leone has a very limited telephone network but some modern equipment, including an ISDN capable central switch. An ITU consultant has been mapping out various Internet strategies for the PTT, SierraTel. A successful 'national Internet day' was recently held, attracting capacity audiences and national media coverage.

Sierratel expects to have over 1000 users in the first year of service as this war torn country begins to rebuild itself following the outbreak of peace. As yet Sierratel has not decided if it will service dialup users itself, or if it will simply be a reseller of leased line Internet service to ISPs who will in turn support end users.

There is also an active private sector store and forward service in the capital city.

Country: SOMALIA

URL:

No information.

Country: SOUTH AFRICA

URL: www.saix.net

South Africa has a relatively well developed telephone network, X.25 service and full Internet facility supplied by the PTT (Telkom SA) as well as a number of multinationals and locally owned companies with their own leased lines to ISPs in the US and UK. Ranked in the top 20 countries worldwide for number of Internet hosts, there are over 30 active private sector service providers, at least 6 international leased line links ranging from 2.8MBps to 64KBps. An extensive academic and research network (UNINET) connects almost all of the tertiary academic institutions, some schools and a variety of academic institutions in Botswana, Ghana, Lesotho, Namibia and Mozambique. There is also active APC NGO service (SANGONet).

The massive development goals of ANC government include a number of objectives to improve access to communications in the country. Large scale basic telecommunications infrastructure building plans are under way. The National Information Technology Forum, a cross-sectoral national ICT policy working group has been formed.

With a 2.5Mbps circuit over the fibre optic cable to the US service provider AlterNet, Telkom's Internet service, SAIX, has the fastest Internet pipe on the continent and this has already attracted over 10 local South African Internet service providers who have been able to cut the costs of their own international leased lines and exploit the higher bandwidth available through SAIX.

This has already attracted the ire of the Internet Service Providers Association (ISPA) of South Africa, a group of ISPs excluding SAIX, who are bringing Telkom before the Competition Board, claiming that as the only supplier of International circuits, it is exploiting its monopoly position to undercut other service providers. The case is unlikely to be resolved before March next year. Meanwhile SAIX is winning over a significant portion of the local ISPs to the fast service with a novel pricing formula.

A 64Kbps 'national' connection costs about \$1000USD a month for a service which provides a 64kbps connection to the national SAIX network of which up to 16kbps can be clocked through to the International router. It is optimised for South African companies and Internet Service Providers that have the majority of their traffic to South African destinations and wish to avoid costly International bandwidth.

A 64Kbps 'international' connection costs about \$4000USD a month but this gives the user a clear 64k connection to the SAIX international router. This is aimed at users that have the majority of their traffic routed to an International destination.

Pricing for ISPs wishing to make use of SAIX's extensive set of dialup POPs around the country (over 20 at last count and SAIX claims to be adding a new one every week) is rumoured to be about \$9 USD a month.

The major drawback of the SAIX service at present is that there is very little local peering with the other South African service providers that are not on the SAIX network. This results in slow traffic which must traverse the International link to the US and back to make the route. The competing ISPs are not interested in improving peering with SAIX at the moment because of competitive pressures and the claims of the ISPA. But as more of their customers complain about poor access to the web sites of the 10 or more ISPs that are connected to SAIX, they may be forced to change their minds.

Country: SUDAN

URL:

One of the major obstacles to connectivity in Sudan stems from lack of a reliable telecommunication infrastructure. The international switch is through an operator, unreliable and noisy. The government has taken various measures in deregulation of the telecommunication sector and private sector fixed wireless telephone services do exist. The restructuring and liberalization of the national telecom company took place a year ago and the national carrier Sudatel is owned privately with 20% government share.

With the establishment of Sudatel plans for digitizing existing analog lines, replacing older unreliable switches with modern high speed switches is underway. Fiber optic links to various regions and within Karthoum are also planned. The University of Gezira has a link via Fidonet to GreenNet in London and plans are to extend the service to other Universities.

Country: SWAZILAND

URL: www.pipex-sz.net

Swaziland has a limited telephone network and one private sector full Internet service provider operating in partnership with UUNET SA as well as a CompuServe/WorldNet gateway access point. The University has been planning a link to the South African academic network for some time.

Country: TANZANIA

URL: twiga.com

The largest problem facing any electronic networking development project in Tanzania is the quality of the telephone infrastructure. For a capital city the situation in Dar es Salaam is extremely poor, even relative to most other African cities - it is virtually impossible to dial from one telephone exchange in the city to another, line quality is very low and fault repair can take many weeks.

The telecom sector is fully liberalised with two competing mobile cellular providers who provide a very popular service due to the poor state of the terrestrial network. The regulator has taken the novel stance of charging normal PSTN rates for calls made to the cellular network from the PSTN, making it possible to provide low cost dialup access via the cell network.

Recently SITA, Wilken and TTCL (the national PTT) won bids to establish Internet services but a private company - Twiga - has already established a full Internet service via a 19.2K link to London carried over the SITA network. TTCL's service will be operated as a joint venture with France Telecom and Nexus International. There are two operational store and forward service providers with about 100 email users. One of the nodes is operated by CST (COSTECH) and the other by the Department of Epidemiology at the Muhimbili Medical Centre (HNETTAN). The success of users wishing to access the system largely depends on their location in the city as this defines the exchange their telephones are connected to, which may or may not be able to dial reliably to the two exchanges where the nodes are located. There also are private sector store and forward services operating in Dar, Arusha and Zanzibar Town.

The University of Tanzania has recently received funding from the Government of the Netherlands for a full Internet via a permanent leased line. In August 1996 this link was established to South Africa via VSAT. Provision of access outside the University clientele is not envisaged, due to the closed user group license obtained.

Country: TCHAD

URL:

Tchad has poor telephone infrastructure, with few international circuits. It has an active X.25 network as well as an NGO store and forward service provider, a RIO node and a SDNP project in advanced stages of implementation.

Country: TOGO

URL:

Togo has a relatively well developed telephone network and an X.25 service. The RIO node was abandoned but will shortly be reinstated. An SDNP project is likely to be started.

Country: UGANDA

URL: imul.com

The telecoms sector in Uganda has been extensively liberalised in preparation for the sale of the national PTT. The country has seen private sector voice and data service providers established and plans for substantial network expansion from the minimal 65 000 lines that are currently available. There is a ruling that if the PTT cannot supply a particular service required within 45 days, then anyone can step in to provide the service.

Two full Internet services operate using VSAT, one terminating in the US and the other in Norway. There is also an active store and forward email service hosted by the University.

Country: ZAIRE

URL:

The telecommunication system in Zaire is the least developed in the region. The PTT operates an old, poorly maintained analogue network with very limited circuits. Most public offices do not have phone lines, and the few that exist either need upgrading or are not operational at all. The Office National de Telecommunication du Zaire (ONPTZ) is however negotiating and seeking external partnership, so as to remedy the situation.

Zaire is the only country in the sub-region to have authorized Private Telecommunication Companies to operate. Two major companies, Telecel and Comcell are operational, with branches in many other parts of Zaire, as well as some neighbouring countries. Tatem Express is the third private telecom company, but its activities are not as elaborate as those of Telecel and Comcell. Communication between these networks is not possible, it is necessary to subscribe to each network in order to communicate with others in that network. Some attempts are being made to exchange calls with the ONPTZ network.

In Zaire the telecommunication charges are levied in US dollars, before being converted in to the local currency. The private telecom companies are charging for both out going and in-coming calls in order to discourage call back. There is no data transmission network but the ONPTZ is pursuing discussions with SITA on how both can collaborate to provide data transmission services to the population, using the existing infrastructure of SITA.

Excluding the private telecom companies that use satellite links, a number of UN based organizations are exploiting satellite links as well, such as UNDP, HCR and WFP. The Meteosat system was also being used but it was destroyed during the 1994 riots.

There is also the possibility of using radio-modems, especially for organisations located inside the country. Two options are available: MOTOROLA-KINSHASA and Mission Aviation Fellowship. Two private organisations have had a long interest in providing Internet Services - the Centre Informatique pour la Formation et la Recherche and Telecel, which attempted to run an email service, but this was short lived because of difficulties with the local phone system.

Country: ZAMBIA

URL: www.zamnet.zm

Zambia has a limited but rapidly improving telephone network in a substantially liberalised market. There is a well established full service Internet provider hosted by the University. Its 9.6K analogue leased line is being upgraded to 64K by installing a C-band VSAT groundstation at the Internet site linking to Telkom SA. ZCCM in the copper-belt is leasing its own line for Internet access via the UK.

Country: ZIMBABWE

URL: www.harare.iafrica.com

Zimbabwe has a limited but slowly improving telephone network in general with some areas of severe problems (poor reliability and long waiting lists for lines). Trunk calls between cities are workable in most cases. An X.25 network is in place and the PTT is planning a national Internet service provided by Sprint with points of presence in secondary cities. 64Kbps leased circuits in Harare have recently become available. The University operates a store and forward service for the academic and health sectors. International donors including SDNP and World Bank are planning to assist various sectors of the community to achieve national and international Internet connectivity.

Recent court rulings have helped to legitimise the three private sector full Internet service providers and the three store and forward NGO service providers, but the private sector ISPs continue to operate in Zimbabwe in a quasi-legal fashion while ZPTC turns a blind eye.